Instructions – Parts List

Parts

FREE-STANDING; CORROSION-RESISTANT OR WATERBORNE

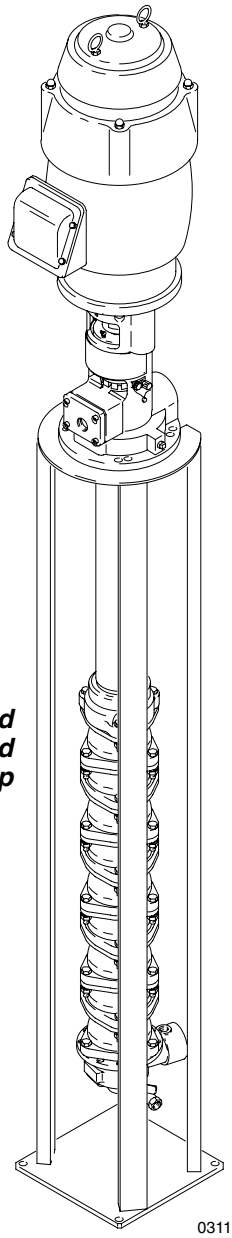
Crown Imperial Pumps

308059L

250 psi (1.7 MPa, 17 bar) Maximum Working Pressure

Electric, Multi-Stage, Centrifugal, Open Stand-Mounted Pumps for Circulating Systems

Read warnings and instructions.
See page 2 for table of contents and list of models.



Motor and Stand Not Included with Pump

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PROVEN QUALITY. LEADING TECHNOLOGY.

Models

No. of Stages	CORROSION-RESISTANT		WATERBORNE		WATERBORNE HD
	Standard Size for 60" High Tanks	High Profile for 85" High Tanks	Standard Size for 60" High Tanks	High Profile for 85" High Tanks	Standard Size for 60" High Tanks
	Model No.	Model No.	Model No.	Model No.	Model No.
6	223906	224006	224106	224206	
7	223907	224007	224107	224207	
8	223908	224008	224108	224208	
9	223909	224009	224109	224209	
10	223910	224010	224110	224210	249103
11	223911	224011	224111	224211	249104
12	223912	224012	224112	224212	249105
13	223913	224013	224113	224213	249106
14	223914	224014	224114	224214	249107
15			236615	236715	249108

Pump mounting stands

Purchase separately.
218631 for Standard-size pump
220266 for High Profile-size pump

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Symbols

Warning Symbol

⚠ WARNING

This symbol alerts you to the possibility of serious injury or death if you do not follow the instructions.

Caution Symbol

⚠ CAUTION

This symbol alerts you to the possibility of damage to or destruction of equipment if you do not follow the corresponding instructions.

⚠ WARNING

EQUIPMENT MISUSE HAZARD

Equipment misuse can cause the equipment to rupture or malfunction and result in serious injury.

- This equipment is for professional use only.
- Read all instruction manuals, tags, and labels before operating the equipment.
- Use the equipment only for its intended purpose. If you are not sure, call your Graco distributor.
- Do not alter or modify this equipment.
- Check equipment daily. Repair or replace worn or damaged parts immediately.
- Do not exceed the maximum working pressure of the lowest rated system component. Refer to the **Technical Data** on page 34 for the maximum working pressure of this equipment.
- Use fluids and solvents which are compatible with the equipment wetted parts. Refer to the **Technical Data** section of all equipment manuals. Read the fluid and solvent manufacturer's warnings.
- Wear hearing protection when operating this equipment.
- Comply with all applicable local, state, and national fire, electrical, and safety regulations.

FIRE, EXPLOSION, AND ELECTRIC SHOCK HAZARD

Improper grounding, poor ventilation, open flames or sparks can cause a hazardous condition and result in a fire or explosion and serious injury.

- Ground the equipment. Refer to **Grounding** on page 5.
- If there is any static sparking or you feel an electric shock while using this equipment, **stop spraying immediately.** Do not use the equipment until you identify and correct the problem.
- Provide fresh air ventilation to avoid the buildup of flammable fumes from solvents or the fluid being sprayed.
- Consult the electric motor manufacturer for the proper heater-breaker requirements.

MOVING PARTS HAZARD

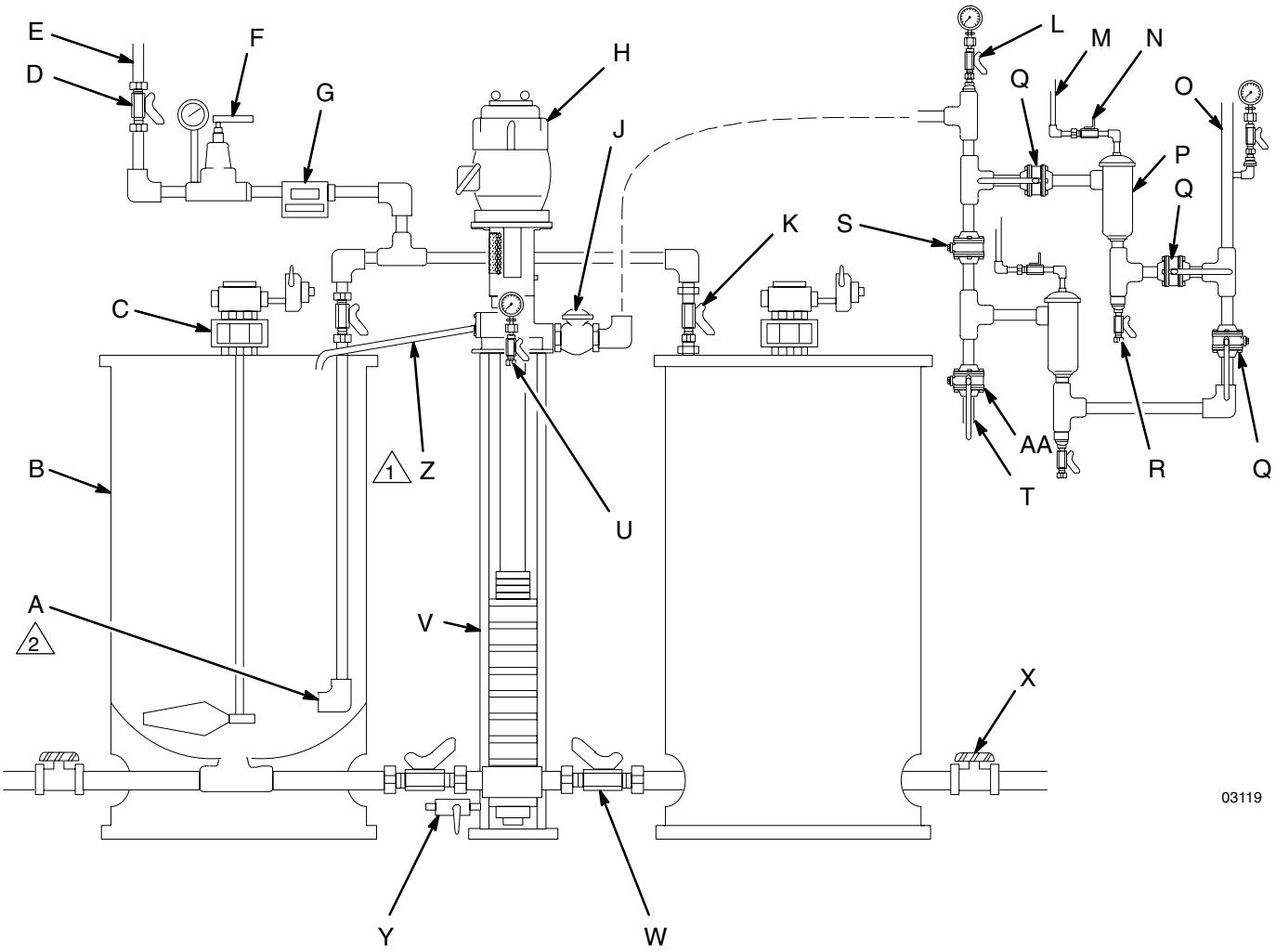
Moving parts in the pump housing can pinch or amputate your fingers.

- Keep clear of all moving parts when starting or operating the pump.
- Keep all tools, etc. away from the moving parts to reduce the risk of accidentally catching and breaking them.
- Before servicing the equipment, shut off the electric power, **relieve the pressure**, and drain the pump by opening the drain valve at the pump base.

HOT SURFACE HAZARD

- The pump housing and pump shaft couplers become hot during operation. To reduce the risk of burning yourself, do not touch them until they have cooled.

Installation



KEY

A Elbow
B Mix Tank
C Agitator
D Shutoff Valve, Return Line
E Return Line
F Back Pressure Valve
G Flow Meter
H Motor
J Check Valve
K Tank Shutoff Valve
L Pressure Gauge with Pulsation Dampener and Isolation Valve
M Open to Air
N Air Blowdown Valve
O To Spray Booth
P Fluid Filter
Q Line Isolation Valve
R Filter Drain Valve
S Standby Pump/System Blowdown Connection Valve
T To Standby Pump
U Outlet Pressure Gauge with Drain Valve
V Open Stand
W Outlet Shutoff Valve
X Tank Drain Valve
Y Pump Drain Valve
Z Drain Tube
AA Safety Isolation Valve

1 Install drain tube at a maximum downward slope to the tank, with a minimum of 1/4 in. (6mm) per foot of tube.

2 To minimize turbulence, extend return line to bottom of tank and use elbow to direct flow around perimeter of tank.

Fig. 1

Installation

Grounding

⚠ WARNING

Ground the pump in accordance with all applicable safety codes in your area. Proper grounding reduces the risk of shock, fire, or explosion caused by static sparking, which can result in serious injury and property damage.

1. Have a licensed electrician complete the electrical hookup and wiring.

2. Consult the electric motor manufacturer for proper heater-breaker requirements.

3. Before coupling the pump coupler to the motor shaft coupler, check to be sure the shaft rotates in the proper direction. Refer to Fig. 3, page 6.

System Design

The **Typical Installation** shown on page 4, and the following text, is only a guide to show the relationship of the pump to other system components. Due to the pressure characteristics of the pump, which vary widely with viscosity and specific gravity, professional systems design is essential. Contact Graco (see back page) for further information.

Pump dimensions and the mounting hole layout are shown on page 30. The **Technical Data** is given on page 32.

Fluid Lines

Line sizes depend on the flow requirements and calculated pressure drop due to the length of the run.

The pipe, tubing and fittings must be compatible with the fluid and solvent you plan to use.

Keep in mind that sharp corners and fittings between lengths of pipe or tubing may cause flow restrictions and fluid breakdown. Use the longest lengths of pipe or tubing available to minimize couplings. Use the most direct route to the spray stations, and whenever practical, use long sweeping bends. A “holsclaw” bender is recommended for making bends in tubing; a common electrician’s or plumber’s bender is not satisfactory.

Remove burrs, dirt and contaminants from the ends of the tubes before installing the fittings.

Return Line

Install a back pressure valve (F) to maintain proper line pressure to all outlets. Install a flow meter (G) to visually check the fluid flow rate.

Extend the return line (E) going into the mix tank (B) to the bottom of the tank and end it with an elbow (A). The elbow directs fluid around the walls of the tank to help minimize air entrainment in the fluid.

Supply Line

Install a line check valve (J) near the 2 in. npt(f) pump outlet.

⚠ CAUTION

The line check valve (J) is required to prevent fluid backflow into the pump in case of a power failure or incorrect operating procedure.

Install a pressure gauge (G) at the plugged 1/2 npt(f) port at the left of the pump outlet. Make sure the gauge is correctly rated for the operating pressure.

Fluid Filters

Install two fluid filters (P) with line isolation valves (Q) on each side. This allows the system to be used while cleaning a filter.

Overflow Tube

See Fig. 2. Remove the plug from the port of the slinger cover (21). In the port; Install a minimum 3/4 in. (19 mm) ID drain tube (Z) for solvent based materials, and a minimum 1 in. (25 mm) ID drain tube for waterborne materials. ***Slope the tube downward, a minimum of .25 in. (6mm) per foot of tube*** and route the tube into the mix tank.

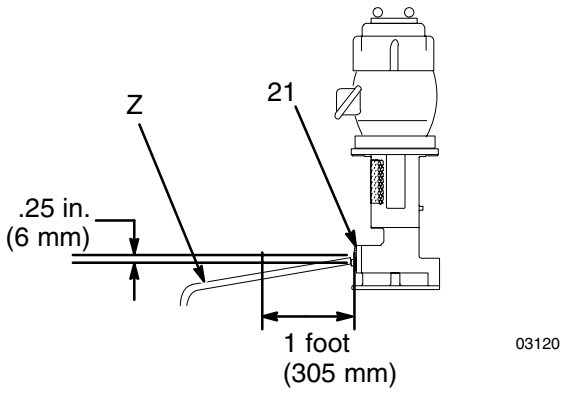


Fig. 2

Installation

Mounting the Pump

Secure the pump, ***without the motor***, in the pump stand (V), using the bolts provided.

Be sure the pump inlet and the plumbing to the mix tanks are at the same level. Install the necessary plumbing, using shims as necessary. Then bolt the pump standpipe and the tanks securely to the floor.

⚠ CAUTION

Do not flush the pump with any acid, caustic or abrasive flush solution (line stripper) of any type. The pump is designed to circulate automotive paint coatings only.

After All Lines Are Installed

Flush all lines with a compatible solvent and blow out with air. Then clean the elements of the filters (P).

Installing the Motor

Remove the protective cover and the shipping dowel from the pump base (31). Remove the motor coupler (29).

When wiring the motor, be sure the shaft rotates in the direction shown on the pump base and in Fig. 3.

Place the motor coupler (29) on the motor shaft (A), pushing it up, well beyond the end of the shaft. Lightly snug the setscrew (B).

Lower the motor onto the pump base, making sure the motor locating flange seats properly on the pump base.

Loosen the motor coupler setscrew (B). Pull the coupler (29) down to engage with the pump coupler (58) and coupling insert (6).

Adjust the motor coupler to 0.094 in. (2.39 mm) clearance. See Fig. 3. Tighten the pump coupler setscrew.

⚠ CAUTION

1. Before operating the pump, turn the motor coupler by hand to be sure the shaft rotates freely in the correct direction. Then recheck the 0.094 in. (2.39 mm) coupler clearance.
2. The pump is factory-set to deliver maximum outlet pressure. Do not tamper with this adjustment as it could cause damage to the impellers and bowls and void the warranty.
3. Never leave any contaminants, nuts, bolts, rags, etc., in the fluid tank or supply lines as they could seriously damage the impellers or bowls.

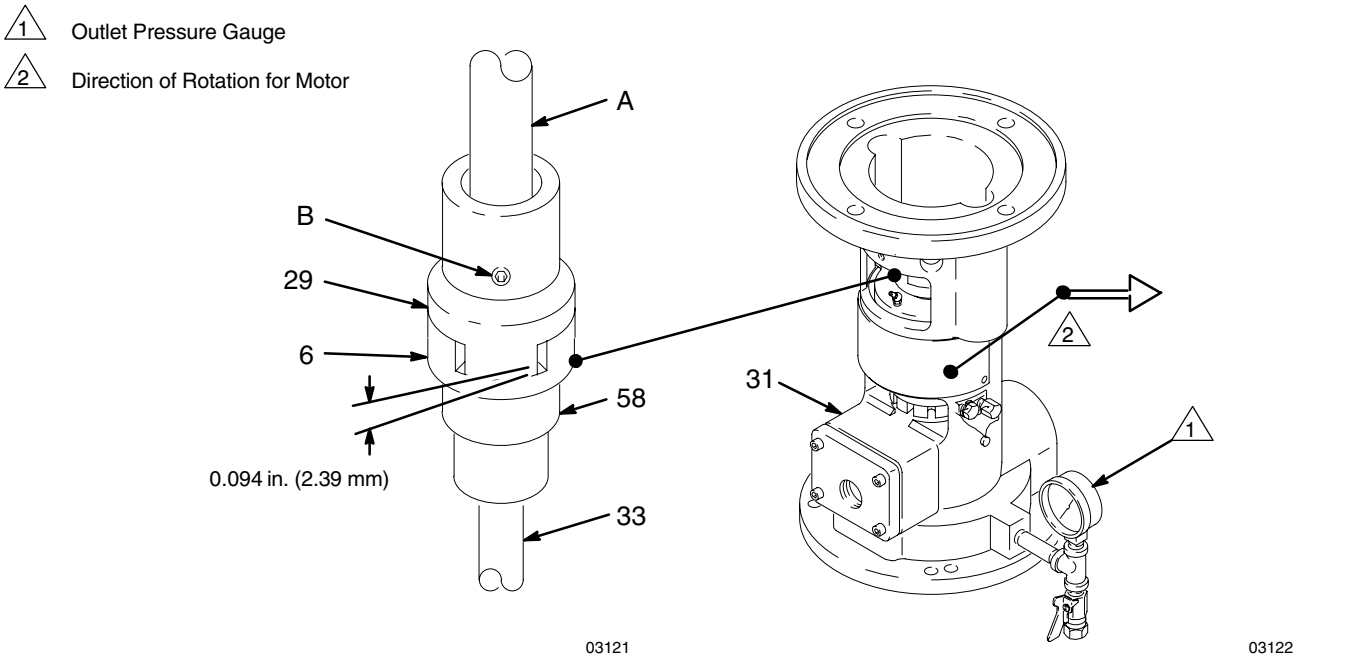


Fig. 3

Operation

⚠ CAUTION

The pump is designed for continuous operation. Regular shutdown at night or on weekends may cause premature bearing wear and invalidate the warranty.

Do not let the pump run dry. Operating the pump for more than 10 seconds without fluid circulating through it will overheat the pump and damage it.

Flushing and Priming System

(See the Typical Installation and Fig. 3.)

The procedure given here is for a stand-mounted pump, two mix tank system as shown in the **Typical Installation** on page 4. Some specific instructions may not apply to other systems; consult your plant's flushing procedures.

Flushing is important; it cleans all equipment and lines of impurities. Following these instructions will help assure satisfactory operation with quality control.

⚠ CAUTION

1. Be sure the motor rotates in the correct direction and the drive coupler clearance is set at 0.094 in. (2.39 mm). See Fig. 3.
2. If the motor labors or the pump does not run smoothly, check the motor for high amp draw and check the thrust bearing for overheating. The normal operating temperature is from 120° to 150° F (49° to 65° C). If the temperature is higher than 150° F (65° C), consult a qualified Graco representative after a repair check of the drive coupler clearance.
3. Be sure the circulating lines are flushed and primed with fluid as instructed below. Do not flush the pump with any acid, caustic or abrasive flush solution (line stripper) of any type. The pump is designed to circulate automotive paint coatings only.

1. Preparing to flush the inside of the mix tanks
   a. Close the outlet valves (W) of both tanks.
   b. Pour about 100 gallons (380 liters) of the appropriate solvent into each tank.
   c. Open the outlet (W) and return valves (K) on one tank only.
2. Starting the pump
   (Always use this procedure to start the pump)
   a. Close the isolation valves (Q) on one filter.
   b. Use the valve (Q) in front of the other filter to control the pump flow to 50 psi (3.5 bar) until the lines are full. Then completely open the valve.
   c. Run the pump for several minutes, and then shut off the pump.
   d. Recheck the drive coupler for 0.094 in. (2.39 mm) clearance.

⚠ CAUTION

The pump coupler and bearing could move up during shipment and then, when the pump is operated, it could move down, leaving too much clearance. This could damage both the coupler insert and the coupler.

3. Checking the system for leaks
   a. Restart the pump and check the entire system for leaks.
   b. Tighten leaking joints as necessary.
   c. Periodically check for leaks during flushing.
4. Continue flushing
   a. Continue circulating the solvent, changing the solvent as needed until the system is thoroughly flushed.
   b. When the system is clean, stop the pump.
   c. Drain all filtered residue from the filters (P).
   d. Reconnect the return line (E) to the back pressure valve (F).

e. Close the outlet (W) and return valves (K) for the tank being used and open the outlet and return valves for the other tank.

f. Start the pump and circulate the solvent for at least one hour.

g. While circulating, open the spray gun at each drop and flush the hoses with about one gallon (4 liters) of solvent.

5. When flushing is complete

   a. Stop the pump and drain all solvent from the tanks and lines.

   b. Open the filter drain valves (R) to flush out all filtered residue.

   c. Thoroughly blow out the entire system with clean, dry compressed air, or nitrogen, to remove all solvent from the system.

6. Pumping paint

   a. Fill a tank with paint and start the agitator (C).

   b. Start the pump.

   c. Use the filter isolation valve (Q) to control the pump flow to 50 psi (3.5 bar) until the lines are full, and then open the valve completely.

   d. Circulate the paint until all air is removed from the fluid lines.

   e. While the paint is circulating, check and adjust the viscosity as necessary.

7. Filling standby tank

   a. Fill the other mix tank *(standby tank)* with paint and start the agitator.

   b. Leave the agitator running so that paint in the standby tank will be ready for use when needed.

   c. To keep air out of the system, always switch to the standby tank before the paint supply in the tank you have been using is completely exhausted.

8. Flushing paint from system

Consult the paint supplier for a compatible solvent for flushing paint from the system. Water reducible paints should use de-ionized water and a solvent which will keep resin in the solution. If water reducible paint has a 20% solvent content, the flush media should also contain approximately 20% solvent.

⚠ CAUTION

Do not flush the pump with any acid, caustic or abrasive flush solution (line stripper) of any type. The pump is designed to circulate automotive paint coatings only.

⚠ CAUTION

De-ionized (D.I.) water is an aggressive, corrosive material. It can be used on the waterborne versions of the Imperial Pumps. Exposure of all other Imperial Pumps to D.I. water should be minimized, and the D.I. water should be flushed from the pump with a non-corrosive material such as alcohol.

Adjusting System Pressure

Use the back pressure valve (F) to adjust the system pressure.

Determine the line pressure required. Then, with paint circulating in the line loop only, set the back pressure valve so that the pressure at the last spray gun is 10 psi (0.7 bar) greater than needed.

Refer to the **Typical Installation** on page 4 and the separate back pressure valve instructions.

⚠ CAUTION

The pump is set at the factory to deliver the maximum volume and outlet pressure. The pressure cannot be increased by any adjustment of the pump. Refer to **Pump Thrust Bearing and Seal Replacement**, page 12, for proper adjustments.

Lubrication

Lubricate the thrust bearing once a month if the pump is operating continuously. To lubricate the bearing, pump one or two shots (about 0.1 oz/2.8 grams) of Chevron SRI/No. 2 NLGI grade grease through the fitting on the top of the seal retainer. A 14 oz. tube of this grease is supplied with the pump. See Fig. 4.

NOTE: Do not lubricate the bearing when you first receive the pump as it is factory greased.

⚠ CAUTION

Use only Chevron SRI/No. 2 NLGI grade grease to help prevent bearing overheating and premature bearing failure. This green or brown-colored grease is used for the factory pack and must not be mixed with any other type of grease. The use of any other type of grease will void the Graco Warranty.

⚠ CAUTION

Do not over grease the bearing, which may cause the bearing to overheat. Remove any excess grease after lubricating.

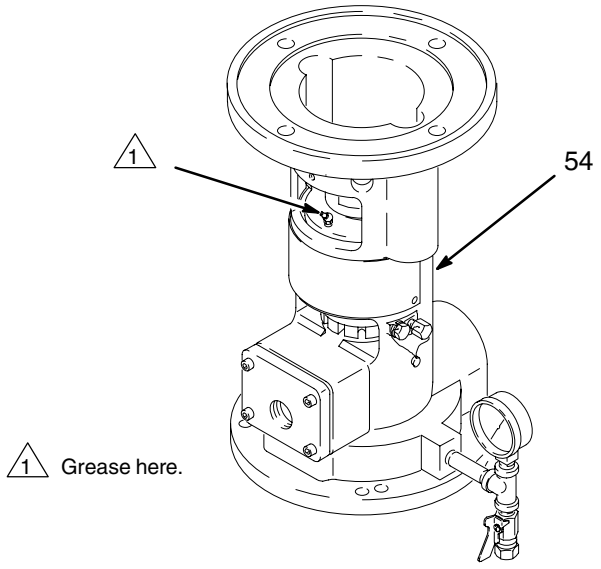


Fig. 4

Thrust Bearing Temperature Monitoring. The 3/8 in. npt plug (54) can be removed from the pump base to install a temperature sensor to monitor thrust bearing temperatures. This sensor can be sourced by an appropriate outside supplier.

Preventive Maintenance

Thrust Bearing. Once a month, lubricate the thrust bearing if pump is run continuously. Refer to thrust bearing **Lubrication** instructions on this page. It is recommended that the Imperial pump thrust bearing assembly be replaced at least once a year.

Pump Pressure, Flow Rate, and Temperature. Once a month, check the static discharge pressure, flow rate of the pump, thrust bearing temperature, and coupler clearance. Record them.

NOTE: If the operating temperature exceeds 150° F (65° C) and normal maintenance, troubleshooting, and service fails to reduce temperature, contact a qualified Graco representative.

⚠ CAUTION

Blockage of the overflow tube and overflow chamber on pump base will cause leakage through the shaft seal and adjustment nut opening.

Overflow Tube. Once a month, check the overflow tube and overflow chamber on pump base. Clean if needed. Refer to Fig. 2 on page 5 for overflow tube setup.

Troubleshooting

⚠ CAUTION

When checking the pump pressure, do not leave the check valve (J) or isolation valves (Q) closed for more than 10 seconds while the pump is operating to avoid overheating the pump and damaging the seals and bearings.

NOTE: Graco offers a rebuild program on all Imperial and Crown Imperial pumps. Contact your local sales representative for details.

⚠ WARNING

Before removing the pump for repair, shut off the electric power, **relieve the pressure**, and drain the pump by opening the drain valve at the pump base. This will help reduce the risk of serious injury from electric shock, moving parts, or splashing fluid in the eyes.

Problem	Cause	Solution
Pump won't run.	1. Electric power out.	1. Check fuses; clean terminals and connections.
	2. Fuses blown.	2. Check coupler clearance, replace fuses, repair pump (call Graco Detroit, see back page).
	3. Motor inoperative.	3. Repair or replace motor.
Pump runs but pressure drops slightly.	1. Clogged pump intake.	1. Remove and clean.
	2. Increased flow rate.	2. Adjust back pressure valve.
	3. Parts worn or damaged.	3. Repair pump.
	4. Air entrained in fluid.	4. *Purge air. See **Startup Procedure** on page 7.
Pump runs but pressure very low or unsteady.	1. Clogged pump inlet.	1. *Clean.
	2. Air entrained in fluid.	2. *Purge air. See **Startup Procedure** on page 7.
	3. Problem with electric motor.	3. Check motor for proper rotation. Check that RPM of motor is at least 3750 under load.

TROUBLESHOOTING CHART IS CONTINUED ON PAGE 11.

* Before removing the pump for cleaning, close the check valve (J) or line isolation valves (Q) and note the maximum pump pressure; the pressure should be steady. **Do not** leave valves closed for more than 10 seconds.

If pressure variations or pulsations are noted, the problem could be 1.) a clogged intake, 2.) too low a fluid level in the tanks, or 3.) restricted plumbing.

Correct the clogged condition to obtain steady pressure.

Low pressure can also be caused by air entrainment in water reducible fluids. All return lines in tanks with water reducible fluid must be routed to the bottom of the tank.

Be careful to avoid allowing deteriorated pieces of bag filters into the pump which can result in serious damage to the pump.

Troubleshooting

Problem	Cause	Solution
Fluid leaking.	1. Screws or fittings loose.	1. Tighten.
	2. Parts worn or damaged.	2. Repair pump.
	3. Clogged bypass drain.	3. Drain.
Leakage at shaft seal (41). (Leakage through the shaft seal/ adjustment nut opening.)	1. Fluid viscosity is too light (especially if using solvent or other flushing material).	1. Seal is designed for heavier viscosity fluid, such as paint. Problem should clear up after flushing is completed.
	2. Drain tube missing or not properly installed.	2. Check size and slope of drain tube; 3/4” ID and minimum slope of 1/4” for each foot of tube. See page 5.
	3. Drain tube blocked.	3. Clean drain tube.
Noisy pump.	1. Improper coupler clearance.	1. Ensure 0.094 in. (2.39 mm) clearance. See Fig. 3, page 6.
	2. Motor not seating properly to pump housing.	2. Loosen motor mount nuts, clean flange and rotate motor to seat properly; check seal for damage.
	3. Lack of grease in main thrust bearing.	3. See **Lubrication** on page 9; check for worn shaft bearings.
Coupler insert (6) wears out prematurely.	Motor not seating properly to pump housing.	Loosen motor mount nuts, clean flange and rotate motor to seat properly; check seal for damage.

Service

⚠ CAUTION

To avoid costly damage to the pump, follow this service procedure carefully. Do not attempt to repair anything that is not mentioned in this service section.

Before you start

Special tools needed for repairing the pump are mentioned in the text and described in the **Accessories** section on page 32. Be sure you have all the necessary tools and repair parts on hand.

Pump Thrust Bearing and Seal Replacement

NOTE: It is not necessary to remove the pump from the stand. However, if you are also repairing the lower pump, you can install the shaft holding tool and move the pump to the repair stand at this time. Use the tool indicated in Fig. 5.

NOTE: Replace the pump thrust bearing (A) assembly at least once a year. Replace the assembly if the pump housing temperature goes over 150°F (53°C), which is the first sign of bearing failure.

Disassembly
(Refer to Fig. 6, except where indicated)

1. Shut off the power to the pump. Close the check valve (J) and/or the line isolation valves (Q). Open the drain valve (Y) at the pump base, having a container ready to catch the fluid. See page 4. Remove the motor. Refer to **Installing the Motor** on page 6.

2. Remove the slinger chamber screws, cover and gasket (3, 21, 20). Inspect the chamber opening and clean out any residue.

3. Remove the retainer plate (58c) and rubber coupling insert (6) from the pump coupling assembly (58). Loosen the slinger (40) setscrew.

4. Hold the pump coupler (58) and screw the shaft nut (28) off the shaft (33), using a socket wrench.

5. Remove the screws, washers and springs (10, 11, 25) and lift out the coupling assembly (58).

6. Remove the bearing support (22) and key (58b) from the shaft (33).

7. Remove the adjusting nut lockscrew and plug (19, 27). Then remove the adjusting nut (35).

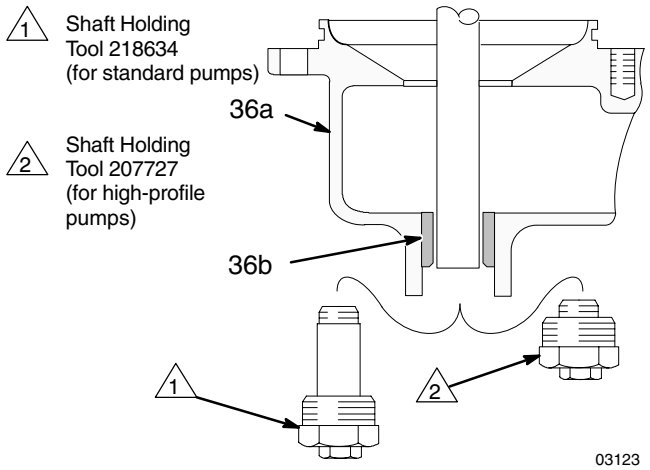


Fig. 5

8. Remove the three screws (13) and shaft seal assembly (41).

NOTE: To service the lower pump section, refer to page 15. Otherwise, continue with Step 9.

9. If the pump is mounted in a repair stand, install the shaft holding tool. See Fig. 5.

10. Install the shaft seal assembly (41) with the three screws (13).

11. Replace the shaft seal (8) in the adjusting nut (35). Install the adjusting nut, engaging just one thread in the pump base (31).

12. Position the bearing support (22) on the adjusting nut (35) so its pin (P) and the slot in the support align.

13. Screw the adjusting nut (35) down just until the bearing support (22) bottoms out on the housing. Turn the nut back 1 to 1-1/2 turns to engage bearing support.

14. Slide the coupling assembly (58) over the shaft (33).

15. Align the keyway and insert the key (58b) between the coupling assembly and shaft.

16. Use the special tool, 178779, to check the shaft location dimension. Place the tool on the face of the coupler (58), between the coupler tabs as shown in the detail of Fig. 7. The tabbed portion of the tool should touch the top of the shaft (33). Screw the adjusting nut (35) up until you attain the 0.25 in. (6.3 mm) dimension.

17. Install the shaft nut (28) using a socket wrench and bottom it on the coupling assembly (58).

18. Align the hex of the nut retainer plate (58c) with the shaft nut (28) and secure the lockwire (58d).

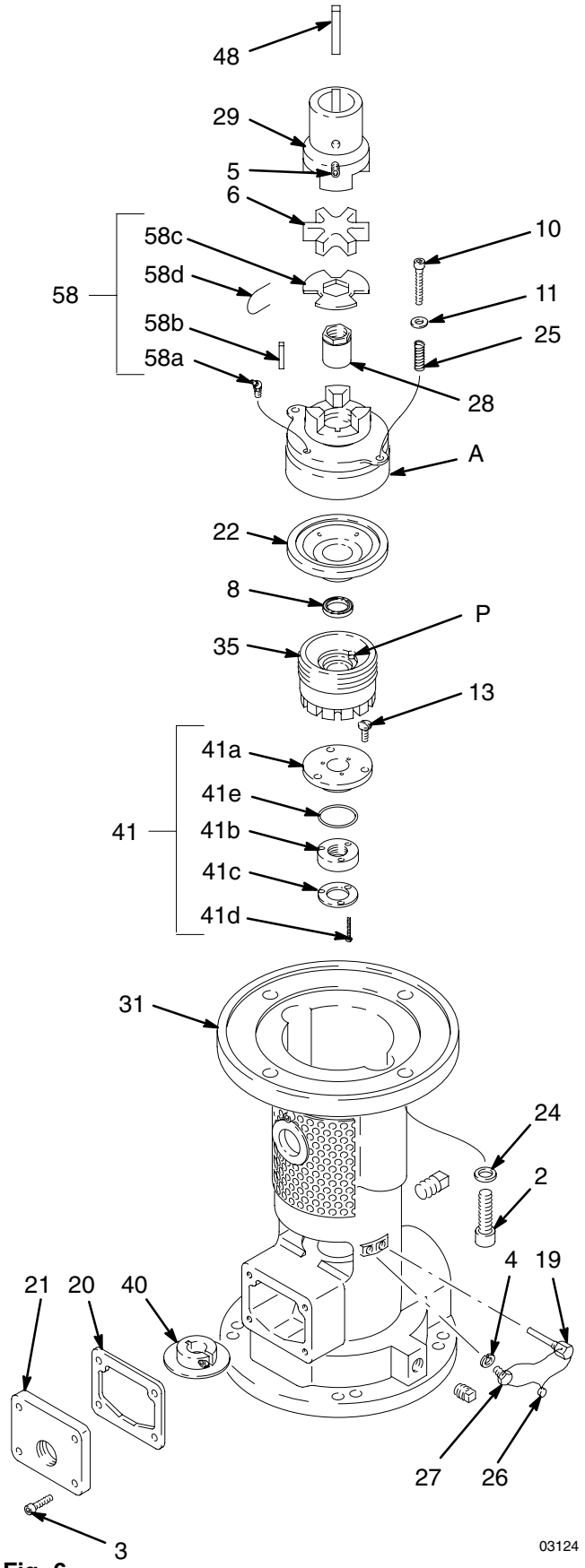


Fig. 6

19. Install the two hold-down screws, washers, and springs (10, 11, 25). Bottom the screws and check the vertical travel of the retainer (A) against the spring. If the shaft nut (28) and coupling housing (58) are properly installed, the retainer should lift 0.12 to 0.19 in. (3.2 to 3.8 mm) before the springs are solidly compressed.

20. ***If the pump is mounted in an assembly stand***, loosen the shaft holding tool. See Fig. 5.

    Turn the bearing adjusting nut (35) two and a half notches to the right to raise the impellers off the bowls. Now turn the pump coupler (58) to be sure the shaft (33) rotates freely. Check to see that the slinger (40) is located approximately in the center of the slinger chamber. See Fig. 7.

    If the pump is not mounted in an assembly stand, turn the bearing adjusting nut (35) up until the shaft (only) rotates freely. Then raise it another two and a half notches to raise the impellers off the bowls. See Fig. 7.

21. Install the lockscrew (19) through the pump base and into the hole in the adjusting nut (35) without forcing it. Install the plug (27). If necessary, turn the adjusting nut a little, in the same direction as pump rotation, until the plug goes in easily. Tighten the plug securely and attach the lockwire (26) and crimp. See Figs. 6 and 7.

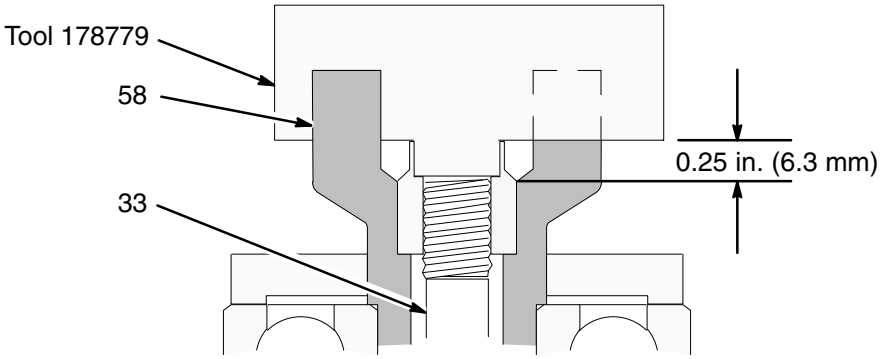
22. Install the gasket, slinger chamber cover, and screws (20, 21, 3) on the front of the pump base.

23. Install the rubber coupling insert (6) and remount the motor. Refer to Fig. 3, page 6.

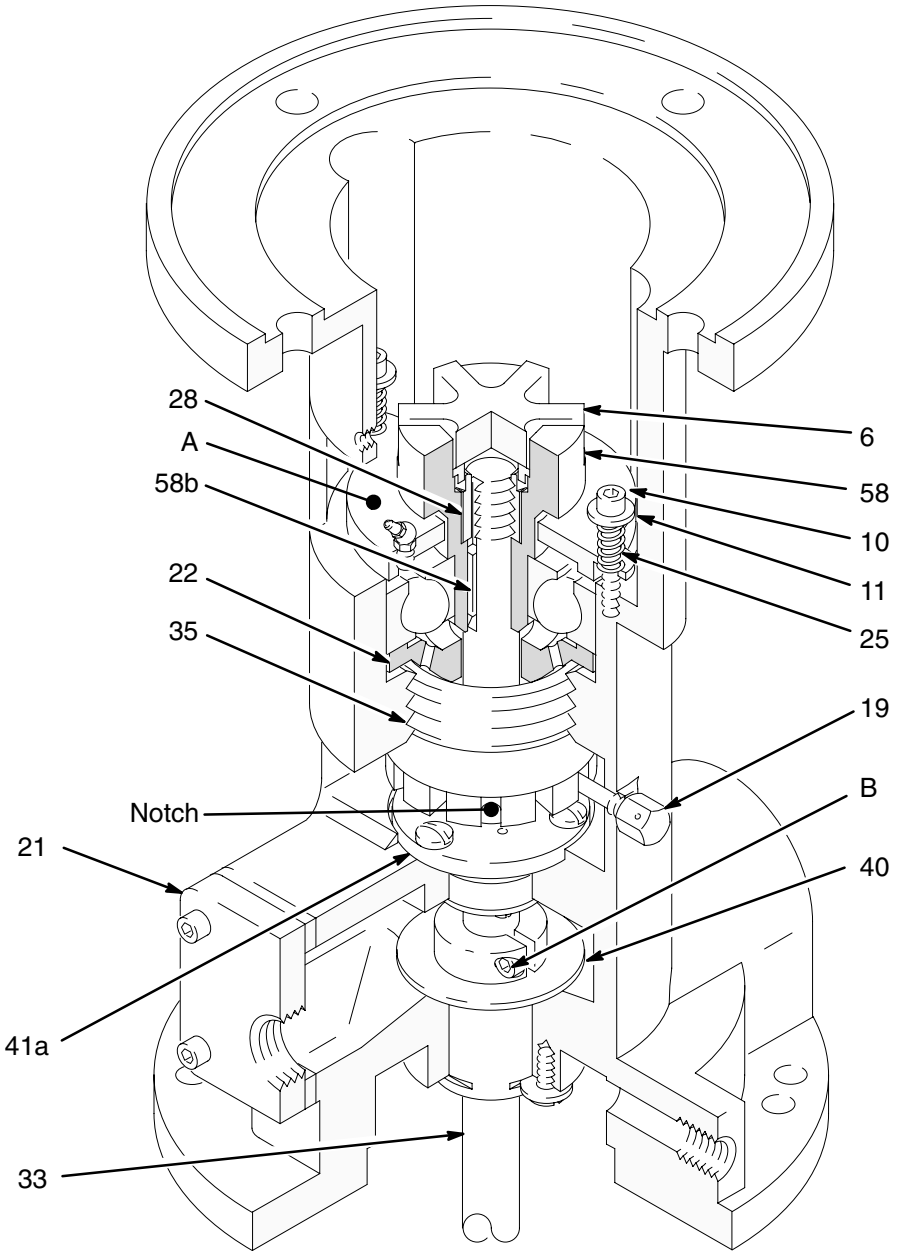
24. Remove the shaft holding tool, if installed. Install the plug (49) and gasket (50) (see the parts drawing). Start the pump. Use the filter isolation valves (Q) to control the pump flow to 50 psi (3.5 bar) until the lines are full, and then completely open the valves. Circulate the paint until all air is removed from the fluid lines. Close the check valve (J) or isolation valves (Q). Note the maximum pump pressure. The pressure should be steady. If variations or pulsations are noted, the inlet flow to the pump is restricted, due to either a clogged screen or restricted plumbing. Correct the clogged condition.

CAUTION

When checking the pump pressure, **do not** leave the check valve (J) or isolation valves (Q) closed for more than 10 seconds while the pump is operating to avoid overheating the pump and damaging the seals and bearings.



03125

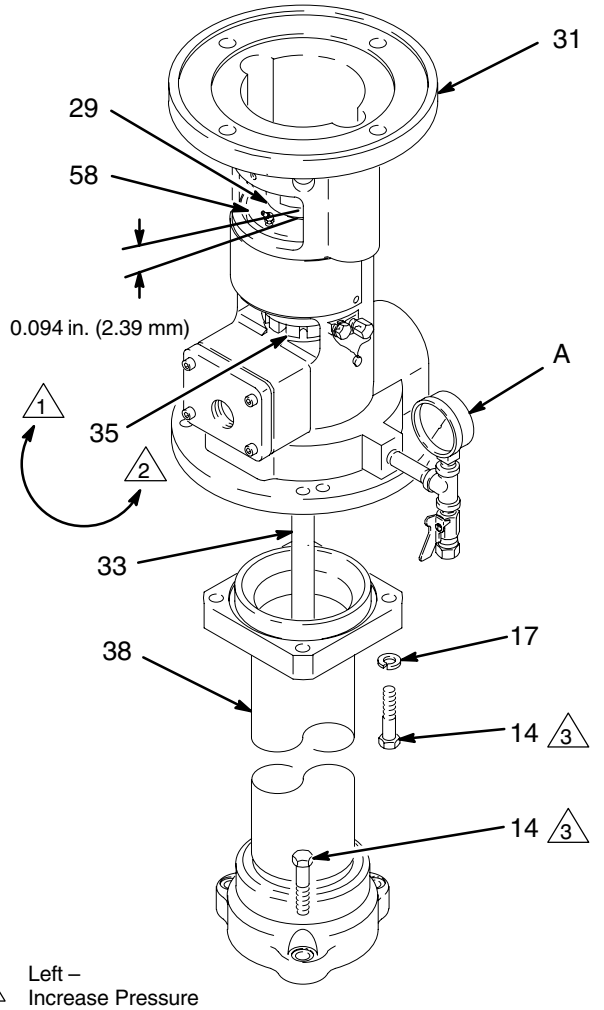


03126

Fig. 7

25. Shut the pump off and recheck the coupler clearance; adjust if necessary to 0.094 in. (2.39 mm). See Fig. 8.

26. Remove the seal chamber cover (21) and check to be sure the slinger (40) is in the middle of the chamber. See Fig. 7. If necessary, loosen the setscrew (B) with a 0.19 in. hex key wrench to readjust the slinger. Reinstall the cover, gasket and screws (3, 20, 21).



△1 Left – Increase Pressure

△2 Right – Decrease Pressure

△3 Torque to 30–35 ft–lb (27–47 N.m)

Fig. 8

Repairing Shaft Bearings, Impellers, and Seals

Disassembly

NOTE: Remove the pump from the regular stand.

1. Support the pump in a vertical position on the accessory stand 953912, which must be bolted to the floor for stability. Lock the pump in place. Refer to Fig. 9.

2. Follow the disassembly procedure, Steps 1–8, on page 12.

3. Remove the capscrews (14) at the top flange of the riser tube (38). See Fig. 8.

NOTE: The two riser tubes used in the High Profile pumps do not have to be disassembled.

4. Lift the pump base (31) straight up, off the shaft (33). Avoid bending the shaft by unequal pulling with a hoist or pry bars. Remove the capscrews (14) at the bottom of the tube and remove the riser tube (38). See Fig. 8.

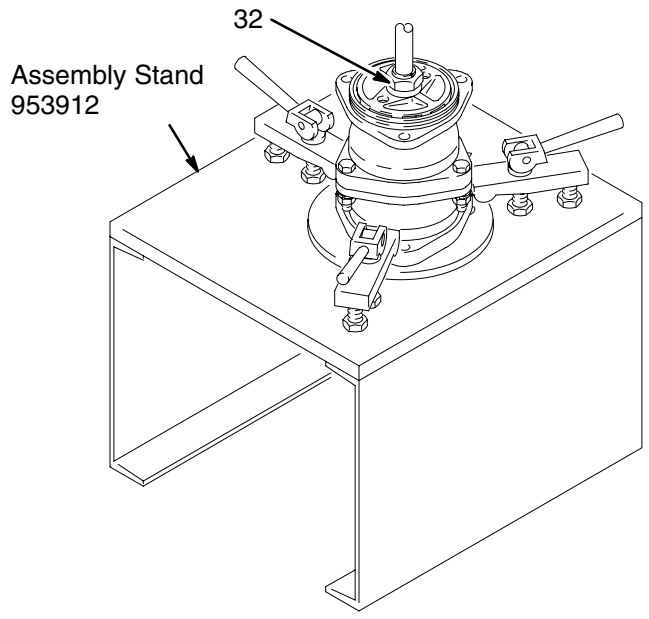


Fig. 9

5. Disassemble the impeller bowls, working from the top down.

   a. Hold the first impeller with a spanner wrench 616637 and use a close fitting wrench to loosen the impeller nut (32) 1–1 /2 turns. See Fig. 9.

   b. Place a 3/4 in. (19 mm) ID soft-steel, protecting bushing, with a smooth turned end, on top of the hex nut. Use a sharp downward blow with a 1 foot (300 mm) length of pipe or tube over the shaft (33) to loosen the collet (18). See Fig. 10.

   c. Remove the collet (18) and impeller (30). Do not pry the impeller.

   d. Remove all of the impeller bowl assemblies in this way.

6. Inspect the shaft (33) for scoring or wear and replace it, if needed. Check all bowls and impellers for wear or damage and replace as needed. Install new o-rings (9) on all impeller bowls (37b) and the intake bowl (36a), then lubricate the o-rings in place. Be sure the impeller nuts (32) rotate freely on the collets.

7. To replace the bearings:

   a. Use the short-nippled end of tool 177219 to press out the bearings (37a) from all bowls (37b) and the intake bowl (36a). See Fig. 11.

   b. Use the long-nippled end of the tool to press new bearings (36b, 37a) into the bowls. This tool maintains the required 0.06 in. (1.6 mm) dimensions of the impeller bowls as shown in Fig. 11.

   c. Thread the shaft holding tool into the bottom of the intake bowl as shown in Fig. 12.

Procedure is continued on page 17.

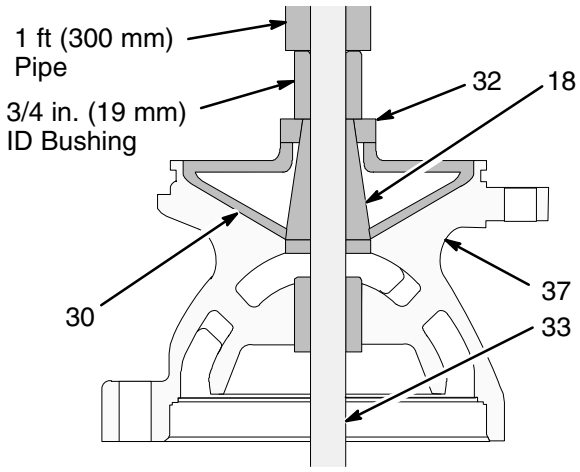


Fig. 10

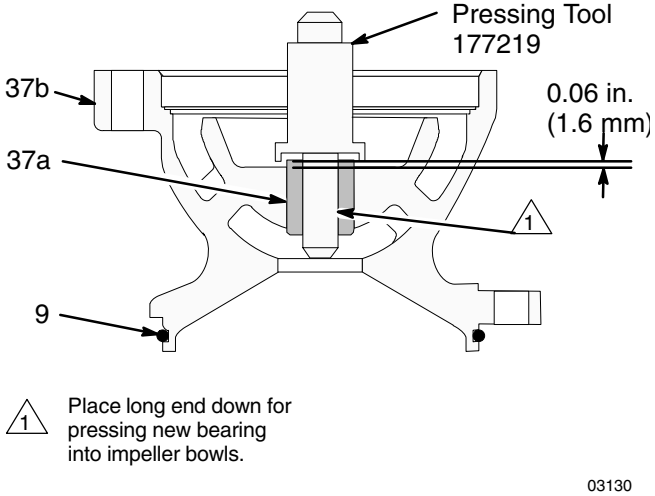


Fig. 11

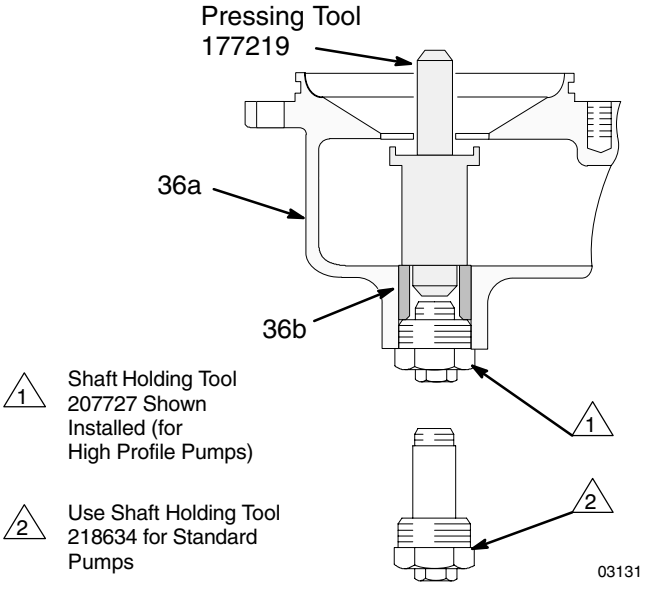


Fig. 12

d. Use the short-nippled end of tool 177219 to press the new bearing into the intake bowl until it bottoms against the shaft holding tool. Refer to Fig. 11.

e. Check the bearings for concentricity. Place the checking fixture 177218 on the bowl as shown in Fig. 13. Drop the long end of the checking tool 177217 into the center hole of the fixture. The tool should turn freely without binding. If the tool binds, the bearings must be replaced.

Reassembly

8. Slide the shaft (33) into the bearing in the intake bowl (36a) and lock it in place with the shaft holding tool. See Fig. 14.

9. Clamp the intake bowl in a vise.

10. Assemble the first impeller (30), collet (18) and impeller nut (32) onto the shaft (33). See Fig. 15. Push downward on the impeller and hold it with the spanner wrench, 616637, while tightening the impeller nut to 130–150 ft-lb (175 – 205 N•m). Refer to Fig. 16.

11. Install the first impeller bowl (37) and bolt it to the intake bowl (36a) with screws (14) and lockwashers (17) and nuts (15). See Fig. 15.

NOTE: Each impeller must be bolted down tightly into the bowl while tightening the impeller. This assures contact with the machined face of the bowl, which will ensure maximum pump performance.

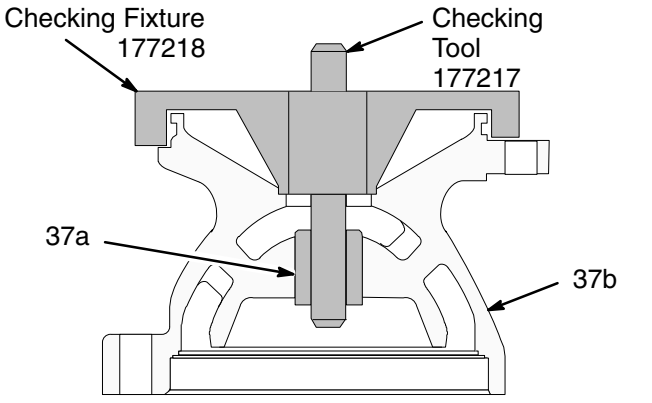


Fig. 13

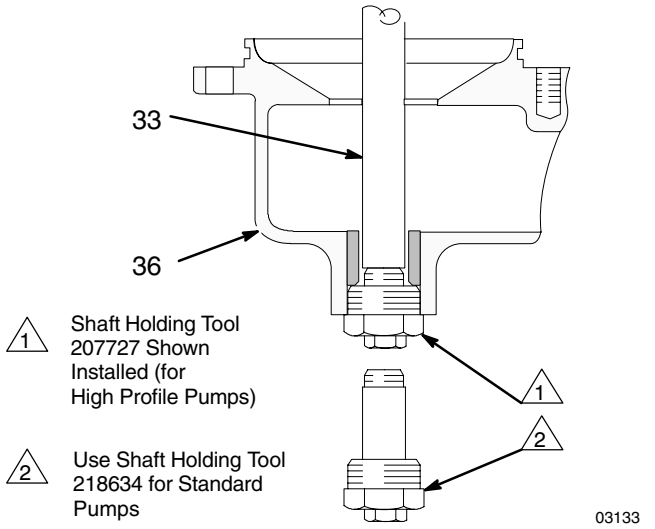


Fig. 14

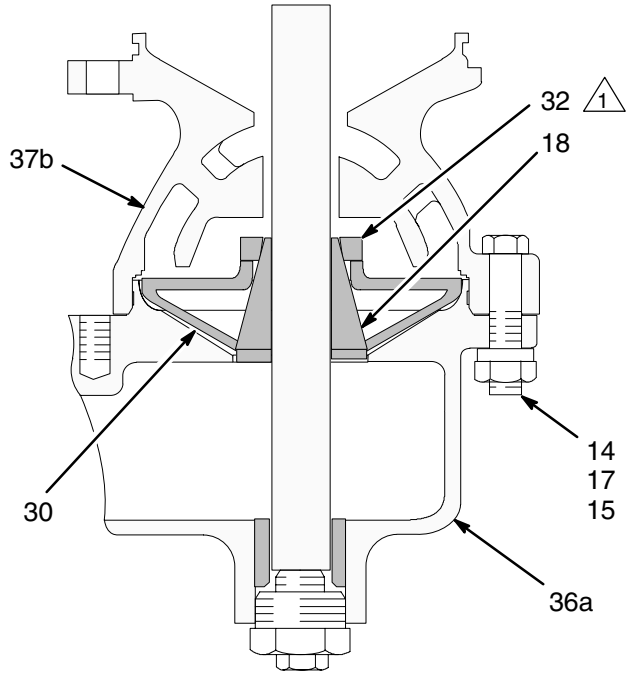


Fig. 15

12. Remove the assembly from the vise and mount it in the assembly stand 953912. See Fig. 16.

13. Continue assembling the bowls and impellers as in Steps 10 and 11.

14. Install the riser tube (38) with the screws (14), lockwashers (17) and nuts (15). See Fig. 8.

15. To replace the bearing (39) in the pump base (31), remove the three screws and washers (7, 34), holding the bearing from below. Press the bearing out, using a 1.5 in. (38 mm) disc laid on the bearing and a 0.68 in. (17.3 mm) rod inserted from the top to push it out. See Fig. 17. This bearing has a medium-tight fit. Replace the bearing when replacing the impeller bearings.

Assembling Lower Pump Section to Base

NOTE: Be sure the pump base (31) is clean, and that a new base bearing (39) has been installed.

1. Install the slinger (40) in the pump base with the flange down. Use a wooden dowel, just under 0.75 in. (19 mm) diameter, to align the slinger when assembling the pump base onto the shaft.

2. Carefully lower the base (31) over the shaft (33), passing the shaft through the bearing and slinger. Seat the base firmly on the riser tube (38). Install the four capscrews (14) and washers (17). Torque to 30–35 ft-lb (27–47 N•m). Refer to Fig. 8.

3. Adjust the slinger to the center of the seal chamber opening. Tighten the slinger setscrew (B). Refer to Fig. 7.

4. Continue assembling the pump as described in Steps 10 to 26 on pages 12 to 15.

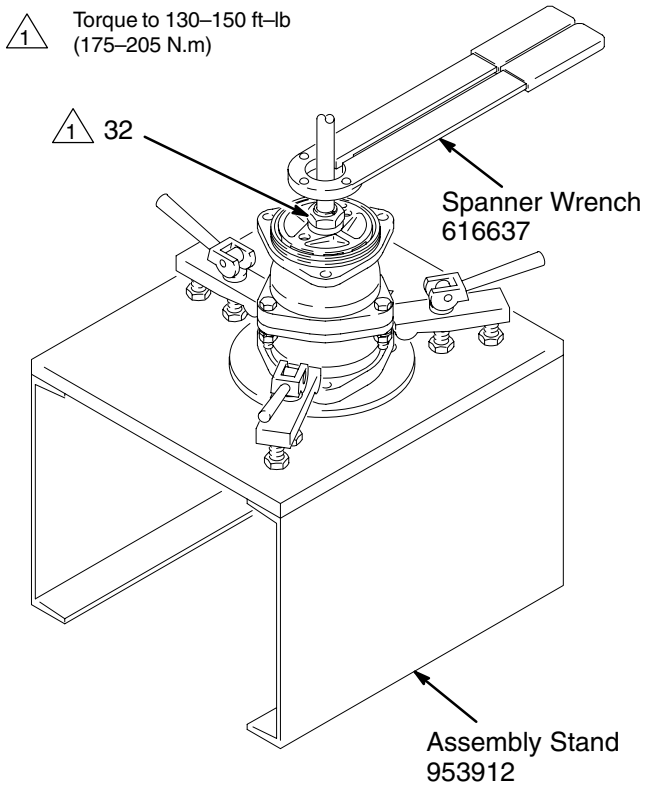


Fig. 16

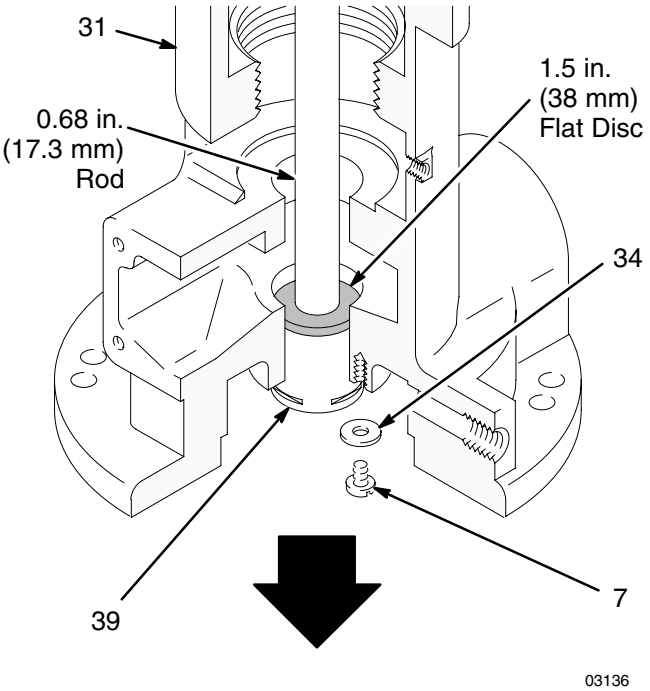
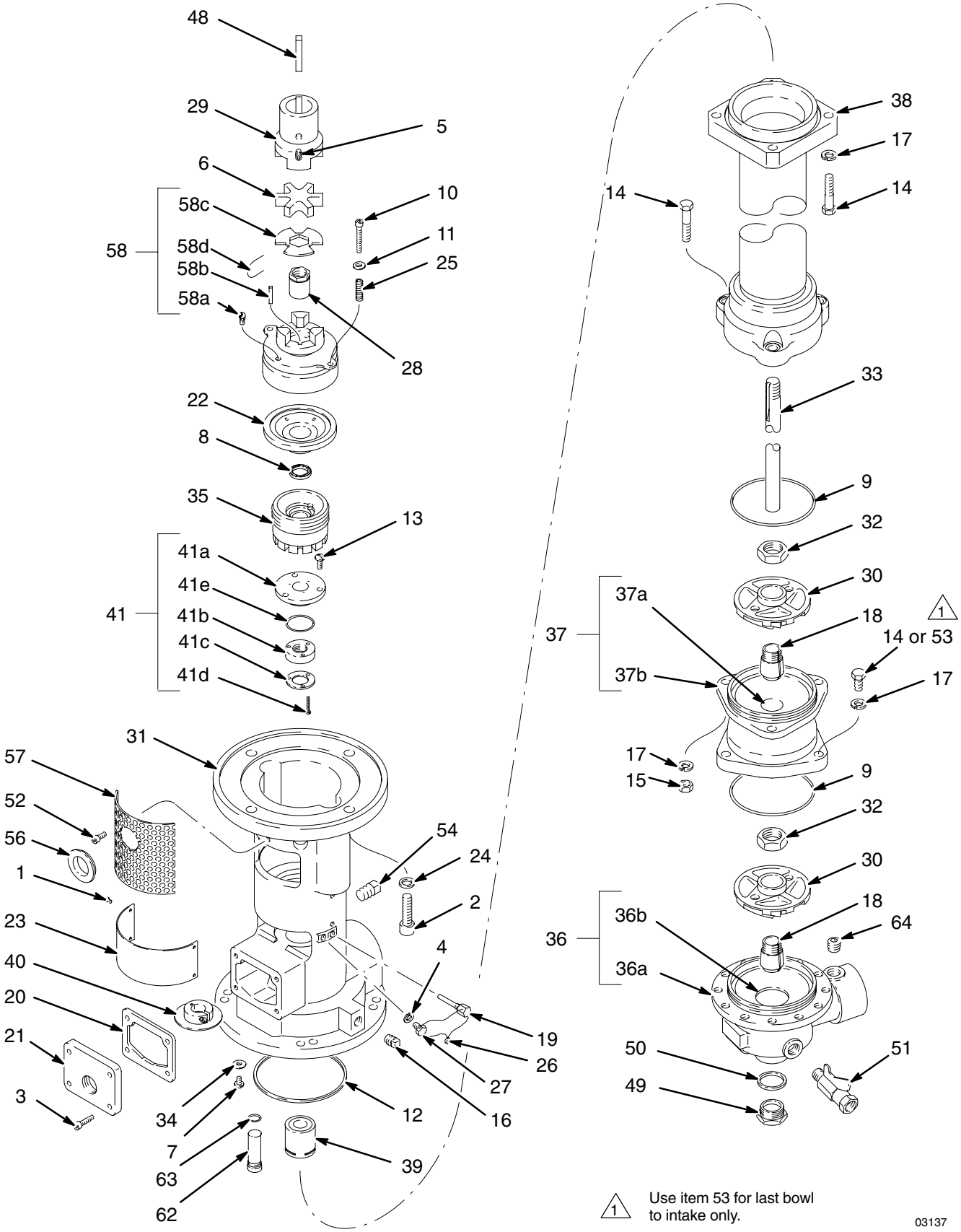


Fig. 17

Notes

Parts

Corrosion-Resistant, 60” Pump



Parts

Corrosion-Resistant, 60” Pumps

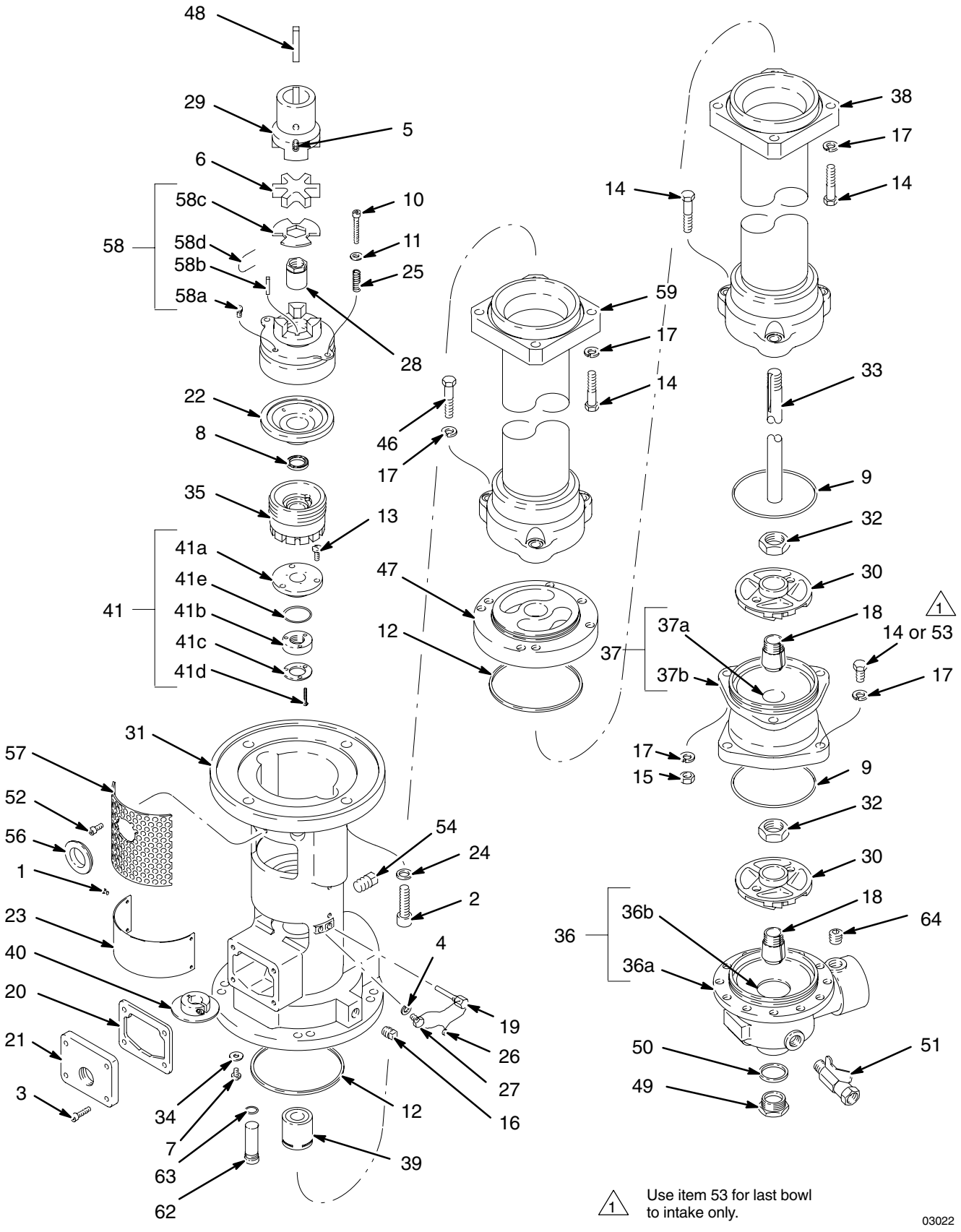
Model	Stages
223906	6
223907	7
223908	8
223909	9
223910	10
223911	11
223912	12
223913	13
223914	14

Ref No.	Part No.	Description	Qty
1	100055	SCREW, type “u” self tap, no. 6 x 1/4”	4
2	110343	CAPSCREW, sochd, 1/2–13 x 1–3/4”	4
3	110787	CAPSCREW, sch, 1/4–28 unf–3a x .75”	4
4	100214	LOCKWASHER, spring, 5/16”	1
5	100640	SCREW, cup pt slotted headless set, 5/16 x 3/8”	1
6	102211*	INSERT, coupling, rubber	1
7	110751	SCREW, mach, pnhd, 1/4–28 unf–2a x .375”	3
8	102776*	SEAL, shaft	1
9	106524*	SEAL, o–ring, Viton ®	
		6 to 11 Stage Pumps	11
		12 & 13 Stage Pumps	13
		14 Stage Pumps	15
10	110753	CAPSCREW, sch, 1/4–28 unf–3a x 1.625”	2
11	110755	WASHER, plain, .281” ID	2
12	102848*	PACKING, sq section	1
13	110752	SCREW, mach, pnhd, 1/4–28 unf–2a x .625”	3
14	103776	SCREW, hex hd, 7/16–14 x 2”	
		6 to 11 Stage Pumps	34
		12 & 13 Stage Pumps	40
		14 Stage Pumps	46
15	103777	NUT, hex, 7/16”	
		6 to 11 Stage Pumps	30
		12 & 13 Stage Pumps	36
		14 Stage Pumps	42
16	110786	PLUG, pipe, 1/4–18 npt	1
17	103780	LOCKWASHER, spring 7/16”	
		6 to 11 Stage Pumps	37
		12 & 13 Stage Pumps	43
		14 Stage Pumps	49
18	186646*	COLLET, impeller	1/Stage
19	168352*	SCREW, lock, adjusting nut	1
20	186117	GASKET, slinger	1
21	191401	COVER, slinger ring	1
22	168363	SUPPORT, bearing	1
23	186124	PLATE, instruction	1
24	168381	WASHER, .53” ID	4
25	186111	SPRING, compression	2
26	104274	LOCK, wire	1
27	171711	PLUG, special	1
28	168500*	NUT, shaft	1
29		COUPLING, motor,	
	170067	fits 1.38” (35 mm) motor shaft	1
	169445	fits 1.12” (28.4 mm) motor shaft	1
30	170748*	IMPELLER, pump	1/Stage
31	186096	BASE, pump	1
32	170770*	NUT, impeller	1/Stage
33	176879	SHAFT, impeller	1
34	170772	WASHER, plain, 1/4”	3
35	207769	NUT, adjusting	1
36	218097	INTAKE BOWL ASSEMBLY	
		Includes item 36a and 36b	1
36a	179909	.HOUSING, intake bowl	1
36b	176851	.BEARING, intake bowl	1
37	218092	IMPELLER BOWL ASSEMBLY	
		Includes items 37a and 37b	
		6 to 11 Stage Pumps	10
		12 & 13 Stage Pumps	12
		14 Stage Pumps	14
37a	176851	.BEARING, impeller bowl	1/bowl
37b	179774	.HOUSING, impeller bowl	1/bowl
38		TUBE, riser	
	218632	24.5” (622 mm)	
		6 to 11 Stage Pumps	1
	220008	17.75” (451 mm)	
		12 & 13 Stage Pumps	1
	220005	11” (280 mm)	
		14 Stage Pumps	1
39	218309	BEARING, pump base	1
40	208846	RING, slinger	1
41	223605*	SHAFT SEAL ASSEMBLY	
		Includes items 41a–41e	1
41a	186215	.SUPPORT, seal	1
41b	178697	.SEAL, shaft, PTFE	1
41c	170762	.RETAINER, seal	1
41d	107246	.SCREW, pan hd mach, no. 5–40 x 5/8”	3
41e	102895*	.PACKING, o–ring, Viton®	1
48		KEY, parallel	1
	107055	5/16”, *use with coupling 170067*	1
	160906	1/4”, *use with coupling 169445*	1
49	178552	PLUG, 1–1/4 NF	1
50	178553	GASKET, plug, Delrin®	1
51	237534	VALVE, ball, 3/8 npt (m x f)	1
52	110754	CAPSCREW, sch, 1/4–28 unf–3a x .5”	1
53	110861	CAPSCREW, hex hd, 7/16–14 unc–2a x 1.5”	3
54	110762	PLUG, pipe, 3/8–18 npt	1
56	108027	GROMMET	1
57	186349	GUARD	1
58	223606	COUPLING ASSEMBLY	
		Includes replacement items 58a–58d	1
58a	100847	.FITTING, hydraulic, 1/4–28, 45°	1
58b	168372	.KEY, 0.187” square x 1” long	1
58c	166007*	.PLATE, retainer, shaft nut	1
58d	068069*	.WIRE, lock	1
61	107411	GREASE, Chevron SRI Grease–2 14 oz.	1
62	186248	PLUG, sealing, machined	2
63	102982	O–RING	2
64	101748	PLUG, 3/8 npt	1

** Recommended spare parts to keep on hand.*

Parts

Corrosion-Resistant, 85” Pump



Parts

Corrosion-Resistant, 85” Pump

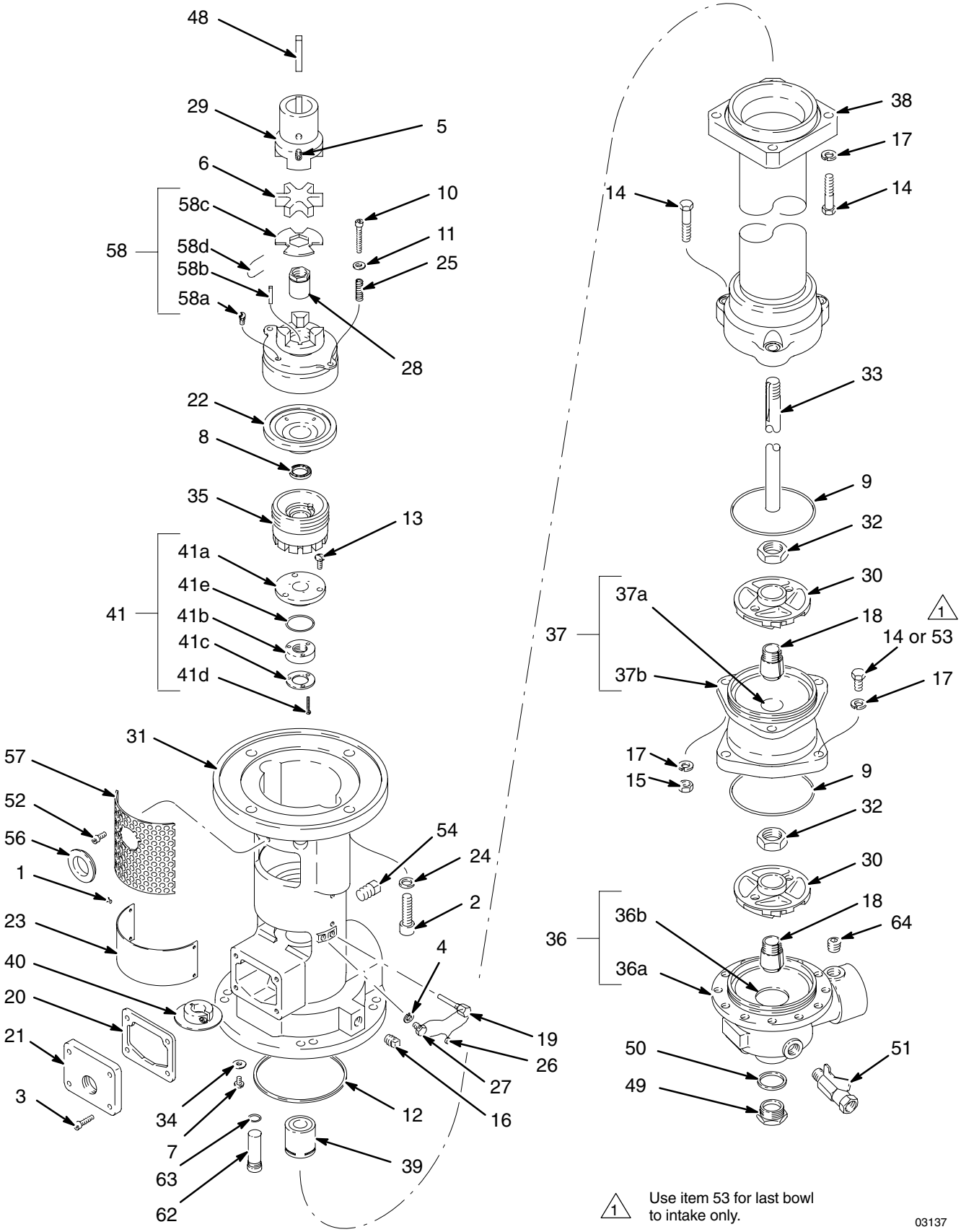
Model	Stages
224006	6
224007	7
224008	8
224009	9
224010	10
224011	11
224012	12
224013	13
224014	14

Ref No.	Part No.	Description	Qty
1	100055	SCREW, type “u” self tap, no. 6 x 1/4”	4
2	110343	CAPSCREW, hex hd, 1/2–13 x 1–3/4”	4
3	110787	CAPSCREW, sch, 1/4–28 unf–3a x .75”	4
4	100214	LOCKWASHER, spring, 5/16”	1
5	100640	SCREW, cup pt slotted headless set, 5/16 x 3/8”	1
6	102211*	INSERT, coupling, rubber	1
7	110751	SCREW, mach, pnhd, 1/4–28 unf–2a x .375”	3
8	102776*	SEAL, shaft	1
9	106524*	SEAL, o–ring, Viton ®	
		6 to 11 Stage Pumps	12
		12 & 13 Stage Pumps	14
		14 Stage Pumps	16
10	110753	CAPSCREW, sch, 1/4–28 unf–3a x 1.625”	2
11	110755	WASHER, plain, .281” ID	2
12	102848*	PACKING, sq section	2
13	110752	SCREW, mach, pnhd, 1/4–28 unf–2a x .625”	3
14	103776	SCREW, hex hd, 7/16–14 x 2”	
		6 to 11 Stage Pumps	38
		12 & 13 Stage Pumps	44
		14 Stage Pumps	50
15	103777	NUT, hex, 7/16”	
		6 to 11 Stage Pumps	30
		12 & 13 Stage Pumps	36
		14 Stage Pumps	42
16	110786	PLUG, pipe, 1/4–18 npt	1
17	103780	LOCKWASHER, spring 7/16”	
		6 to 11 Stage Pumps	44
		12 & 13 Stage Pumps	50
		14 Stage Pumps	56
18	186646*	COLLET, impeller	1/Stage
19	168352*	SCREW, lock, adjusting nut	1
20	186117	GASKET, slinger	1
21	191401	COVER, slinger ring	1
22	168363	SUPPORT, bearing	1
23	186124	PLATE, instruction	1
24	168381	WASHER, .53” ID	4
25	186111	SPRING, compression	2
26	104274	LOCK, wire	1
27	171711	PLUG, special	1
28	168500*	NUT, shaft	1
29		COUPLING, motor	
	170067	fits 1.38” (35 mm) motor shaft	1
	169445	fits 1.12” (28.4 mm) motor shaft	1
30	170748*	IMPELLER, pump	1/Stage
31	186096	BASE, pump	1
32	170770*	NUT, impeller	1/Stage
33	181590	SHAFT, impeller	1
34	170772	WASHER, plain, 1/4”	3
35	207769	NUT, adjusting	1
36	218097	INTAKE BOWL ASSEMBLY	
		Includes item 36a and 37b	1
36a	179909	.HOUSING, intake bowl	1
36b	176851	.BEARING, intake bowl	1
37	218092	IMPELLER BOWL ASSEMBLY	
		Includes items 37a and 37b	
		6 to 11 Stage Pumps	10
		12 & 13 Stage Pumps	12
		14 Stage Pumps	14
37a	176851	.BEARING, impeller bowl	1/bowl
37b	179774	.HOUSING, impeller bowl	1/bowl
38	218632	TUBE, riser, 24.5” (622 mm)	
		6 to 11 Stage Pumps	2
		12 to 14 Stage Pumps	1
39	218309	BEARING, pump base	1
40	208846	RING, slinger	1
41	223605*	SHAFT SEAL ASSEMBLY	
		Includes items 41a–41e	1
41a	186215	.SUPPORT, seal	1
41b	178697	.SEAL, shaft, PTFE	1
41c	170762	.RETAINER, seal	1
41d	107246	.SCREW, pan hd mach, no. 5–40 x 5/8”	3
41e	102895*	.PACKING, o–ring, Viton®	1
46	110862	CAPSCREW, hex hd, 7/16–14 unc–2a x 1.75”	3
47	220267	PLATE, adapter	
48		KEY, parallel	1
	107055	5/16”, *use with coupling 170067*	1
	160906	1/4”, *use with coupling 169445*	1
49	178552	PLUG, 1–1/4 NF	1
50	178553	GASKET, plug, Delrin®	1
51	237534	VALVE, ball, 3/8 npt (m x f)	1
52	110754	CAPSCREW, sch, 1/4–28 unf–3a x .5”	1
53	110861	CAPSCREW, hex hd, 7/16–14 unc–2a x 1.5”	3
54	110762	PLUG, pipe, 3/8–18 npt	1
56	108027	GROMMET	1
57	186349	GUARD	1
58	223606	COUPLING ASSEMBLY	
		Includes replacement items 58a–58d	1
58a	100847	.FITTING, hydraulic, 1/4–28, 45°	1
58b	168372	.KEY, 0.187” square x 1” long	1
58c	166007*	.PLATE, retainer, shaft nut	1
58d	068069*	.WIRE, lock	1
59		SPACER	
	220008	17.75” (451 mm)	
		12 & 13 Stage Pumps	1
	220005	11” (280 mm)	
		14 Stage Pumps	1
61	107411	GREASE, Chevron SRI Grease–2 14 oz.	1
62	186248	PLUG, sealing	2
63	102982	O–RING	2
64	101748	PLUG, 3/8 npt	1

** Recommended spare parts to keep on hand.*

Parts

Waterborne, 60” Pump



Parts

Waterborne, 60” Pump

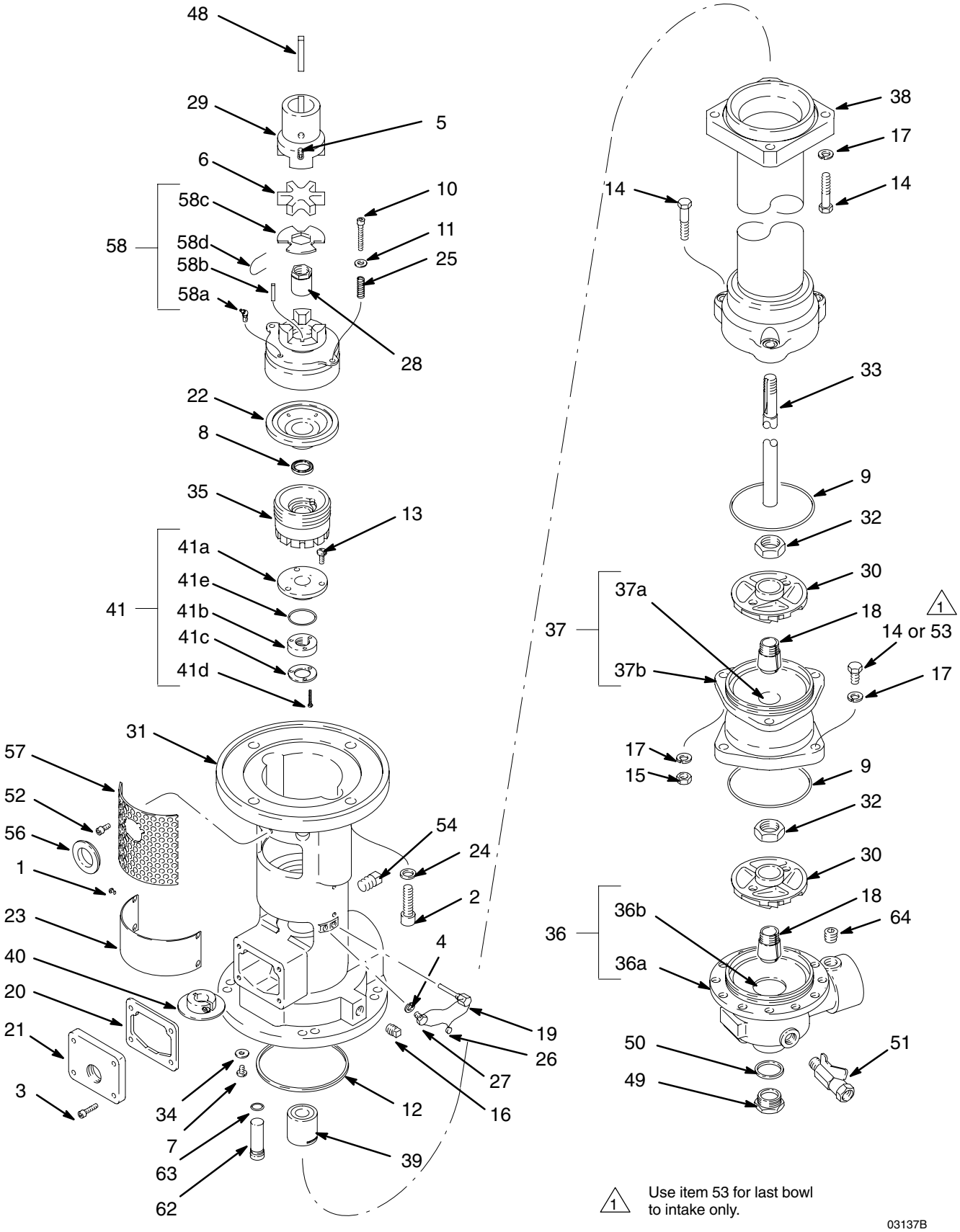
Model	Stages
224106	6
224107	7
224108	8
224109	9
224110	10
224111	11
224112	12
224113	13
224114	14
236615	15

Ref No.	Part No.	Description	Qty
1	100055	SCREW, type “u” self tap, no. 6 x 1/4”	4
2	110343	CAPSCREW, sochd, 1/2–13 x 1–3/4”	4
3	110787	CAPSCREW, sch, 1/4–28 unf–3a x .75”	4
4	100214	LOCKWASHER, spring, 5/16”	1
5	100640	SCREW, cup pt slotted headless set, 5/16 x 3/8”	1
6	102211*	INSERT, coupling, rubber	1
7	110751	SCREW, mach, pnhd, 1/4–28 unf–2a x .375”	3
8	102776*	SEAL, shaft	1
9	106524*	SEAL, o–ring, Viton ®	
		6 to 11 Stage Pumps	11
		12 & 13 Stage Pumps	13
		14 & 15 Stage Pumps	15
10	110753	CAPSCREW, sch, 1/4–28 unf–3a x 1.625”	2
11	110755	WASHER, plain, .281” ID	2
12	102848*	PACKING, sq section	1
13	110752	SCREW, mach, pnhd, 1/4–28 unf–2a x .625”	3
14	103776	SCREW, hex hd, 7/16–14 x 2”	
		6 to 11 Stage Pumps	34
		12 & 13 Stage Pumps	40
		14 & 15 Stage Pumps	46
15	103777	NUT, hex, 7/16”	
		6 to 11 Stage Pumps	30
		12 & 13 Stage Pumps	36
		14 & 15 Stage Pumps	42
16	110786	PLUG, pipe, 1/4–18 npt	1
17	103780	LOCKWASHER, spring 7/16”	
		6 to 11 Stage Pumps	37
		12 & 13 Stage Pumps	43
		14 & 15 Stage Pumps	49
18	186646*	COLLET, impeller	1/Stage
19	168352*	SCREW, lock, adjusting nut	1
20	186117	GASKET, slinger	1
21	191401	COVER, slinger ring	1
22	168363	SUPPORT, bearing	1
23	186124	PLATE, instruction	1
24	168381	WASHER, .53” ID	4
25	186111	SPRING, compression	2
26	104274	LOCK, wire	1
27	171711	PLUG, special	1
28	168500*	NUT, shaft	1
29		COUPLING, motor,	
	170067	fits 1.38” (35 mm) motor shaft	1
	169445	fits 1.12” (28.4 mm) motor shaft	1
30	170748*	IMPELLER, pump	1/Stage
31	186266	BASE, pump	1
32	170770*	NUT, impeller	1/Stage
33	176879	SHAFT, impeller	1
34	170772	WASHER, plain, 1/4”	3
35	207769	NUT, adjusting	1
36	218097	INTAKE BOWL ASSEMBLY	
		Includes item 36a and 36b	1
36a	179909	.HOUSING, intake bowl	1
36b	176851	.BEARING, intake bowl	1
37	218092	IMPELLER BOWL ASSEMBLY	
		Includes items 37a and 37b	
		6 to 11 Stage Pumps	10
		12 & 13 Stage Pumps	12
		14 & 15 Stage Pumps	14
37a	176851	.BEARING, impeller bowl	1/bowl
37b	179774	.HOUSING, impeller bowl	1/bowl
38		TUBE, riser	
	218632	24.5” (622 mm)	
		6 to 11 Stage Pumps	1
	220008	17.75” (451 mm)	
		12 & 13 Stage Pumps	1
	220005	11” (280 mm)	
		14 & 15 Stage Pumps	1
39	218309	BEARING, pump base	1
40	208846	RING, slinger	1
41	223605*	SHAFT SEAL ASSEMBLY	
		Includes items 41a–41e	1
41a	186215	.SUPPORT, seal	1
41b	178697	.SEAL, shaft, PTFE	1
41c	170762	.RETAINER, seal	1
41d	107246	.SCREW, pan hd mach, no. 5–40 x 5/8”	3
41e	102895*	.PACKING, o–ring, Viton®	1
48		KEY, parallel	1
	107055	5/16”, *use with coupling 170067*	1
	160906	1/4”, *use with coupling 169445*	1
49	178552	PLUG, 1–1/4 NF	1
50	178553	GASKET, plug, Delrin®	1
51	237534	VALVE, ball, 3/8 npt (m x f)	1
52	110754	CAPSCREW, sch, 1/4–28 unf–3a x .5”	1
53	110861	CAPSCREW, hex hd, 7/16–14 unc–2a x 1.5”	3
54	110762	PLUG, pipe, 3/8–18 npt	1
56	108027	GROMMET	1
57	186349	GUARD	1
58	223606	COUPLING ASSEMBLY	
		Includes replacement items 58a–58d	1
58a	100847	.FITTING, hydraulic, 1/4–28, 45°	1
58b	168372	.KEY, 0.187” square x 1” long	1
58c	166007*	.PLATE, retainer, shaft nut	1
58d	068069*	.WIRE, lock	1
61	107411	GREASE, Chevron SRI Grease–2 14 oz.	1
62	186248	PLUG, sealing, machined	2
63	102982	O–RING	2
64	101748	PLUG, 3/8 npt	1

** Recommended spare parts to keep on hand.*

Parts

Waterborne HD, 60” Pump



Parts

Waterborne HD, 60” Pump

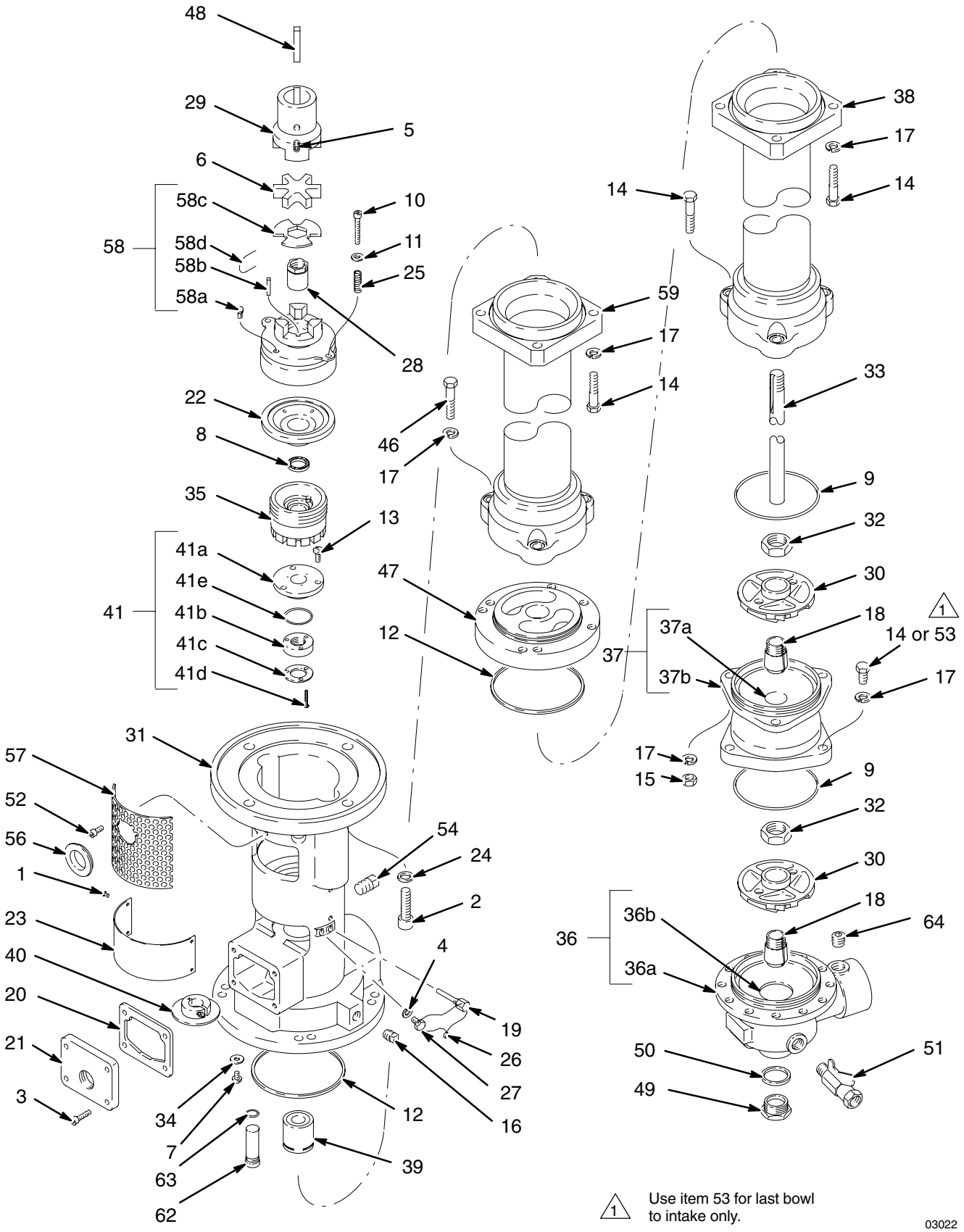
Model	Stages
224106	6
224107	7
224108	8
224109	9
224110	10
224111	11
224112	12
224113	13
224114	14
236615	15

Ref No.	Part No.	Description	Qty
1	100055	SCREW, type “u” self tap, no. 6 x 1/4”	4
2	110343	CAPSCREW, sochd, 1/2–13 x 1–3/4”	4
3	110787	CAPSCREW, sch, 1/4–28 unf–3a x .75”	4
4	100214	LOCKWASHER, spring, 5/16”	1
5	100640	SCREW, cup pt slotted headless set, 5/16 x 3/8”	1
6	102211*	INSERT, coupling, rubber	1
7	110751	SCREW, mach, pnhd, 1/4–28 unf–2a x .375”	3
8	102776*	SEAL, shaft	1
9	106524*	SEAL, o–ring, Viton ®	
		6 to 11 Stage Pumps	11
		12 & 13 Stage Pumps	13
		14 & 15 Stage Pumps	15
10	110753	CAPSCREW, sch, 1/4–28 unf–3a x 1.625”	2
11	110755	WASHER, plain, .281” ID	2
12	102848*	PACKING, sq section	1
13	110752	SCREW, mach, pnhd, 1/4–28 unf–2a x .625”	3
14	103776	SCREW, hex hd, 7/16–14 x 2”	
		6 to 11 Stage Pumps	34
		12 & 13 Stage Pumps	40
		14 & 15 Stage Pumps	46
15	103777	NUT, hex, 7/16”	
		6 to 11 Stage Pumps	30
		12 & 13 Stage Pumps	36
		14 & 15 Stage Pumps	42
16	110786	PLUG, pipe, 1/4–18 npt	1
17	103780	LOCKWASHER, spring 7/16”	
		6 to 11 Stage Pumps	37
		12 & 13 Stage Pumps	43
		14 & 15 Stage Pumps	49
18	186646*	COLLET, impeller	1/Stage
19	168352*	SCREW, lock, adjusting nut	1
20	186117	GASKET, slinger	1
21	191401	COVER, slinger ring	1
22	168363	SUPPORT, bearing	1
23	186124	PLATE, instruction	1
24	168381	WASHER, .53” ID	4
25	186111	SPRING, compression	2
26	104274	LOCK, wire	1
27	171711	PLUG, special	1
28	168500*	NUT, shaft	1
29		COUPLING, motor,	
	170067	fits 1.38” (35 mm) motor shaft	1
	169445	fits 1.12” (28.4 mm) motor shaft	1
30	170748*	IMPELLER, pump	1/Stage
31	186266	BASE, pump	1
32	170770*	NUT, impeller	1/Stage
33	15E264	SHAFT, impeller	1
34	170772	WASHER, plain, 1/4”	3
35	207769	NUT, adjusting	1
36	249110	INTAKE BOWL ASSEMBLY	
		Includes item 36a and 36b	1
36a	179909	.HOUSING, intake bowl	1
36b	15E310	.BEARING, intake bowl	1
37	249109	IMPELLER BOWL ASSEMBLY	
		Includes items 37a and 37b	
		6 to 11 Stage Pumps	10
		12 & 13 Stage Pumps	12
		14 & 15 Stage Pumps	14
37a	15E310	.BEARING, impeller bowl	1/bowl
37b	179774	.HOUSING, impeller bowl	1/bowl
38		TUBE, riser	
	218632	24.5” (622 mm)	
		6 to 11 Stage Pumps	1
	220008	17.75” (451 mm)	
		12 & 13 Stage Pumps	1
	220005	11” (280 mm)	
		14 & 15 Stage Pumps	1
39	15E309	BEARING, pump base	1
40	208846	RING, slinger	1
41	223605*	SHAFT SEAL ASSEMBLY	
		Includes items 41a–41e	1
41a	186215	.SUPPORT, seal	1
41b	178697	.SEAL, shaft, PTFE	1
41c	170762	.RETAINER, seal	1
41d	107246	.SCREW, pan hd mach, no. 5–40 x 5/8”	3
41e	102895*	.PACKING, o–ring, Viton®	1
48		KEY, parallel	1
	107055	5/16”, *use with coupling 170067*	1
	160906	1/4”, *use with coupling 169445*	1
49	178552	PLUG, 1–1/4 NF	1
50	178553	GASKET, plug, Delrin®	1
51	237534	VALVE, ball, 3/8 npt (m x f)	1
52	110754	CAPSCREW, sch, 1/4–28 unf–3a x .5”	1
53	110861	CAPSCREW, hex hd, 7/16–14 unc–2a x 1.5”	3
54	110762	PLUG, pipe, 3/8–18 npt	1
56	108027	GROMMET	1
57	186349	GUARD	1
58	223606	COUPLING ASSEMBLY	
		Includes replacement items 58a–58d	1
58a	100847	.FITTING, hydraulic, 1/4–28, 45°	1
58b	168372	.KEY, 0.187” square x 1” long	1
58c	166007*	.PLATE, retainer, shaft nut	1
58d	068069*	.WIRE, lock	1
61	107411	GREASE, Chevron SRI Grease–2 14 oz.	1
62	186248	PLUG, sealing, machined	2
63	102982	O–RING	2
64	101748	PLUG, 3/8 npt	1

** Recommended spare parts to keep on hand.*

Parts

Waterborne, 85” Pump



Parts

Waterborne, 85” Pump

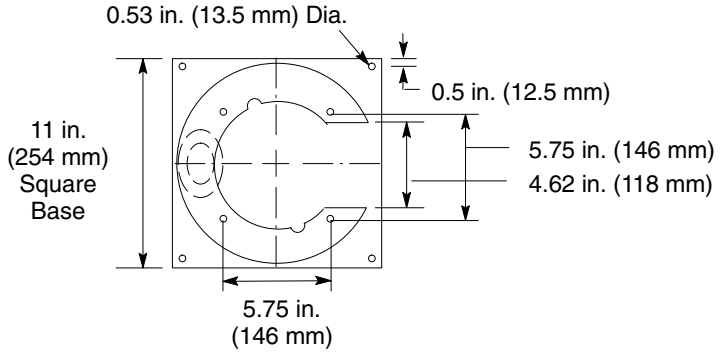
Model	Stages
224206	6
224207	7
224208	8
224209	9
224210	10
224211	11
224212	12
224213	13
224214	14
236715	15

Ref No.	Part No.	Description	Qty
1	100055	SCREW, type “u” self tap, no. 6 x 1/4”	4
2	110343	CAPSCREW, hex hd, 1/2–13 x 1–3/4”	4
3	110787	CAPSCREW, sch, 1/4–28 unf–3a x .75”	4
4	100214	LOCKWASHER, spring, 5/16”	1
5	100640	SCREW, cup pt slotted headless set, 5/16 x 3/8”	1
6	102211*	INSERT, coupling, rubber	1
7	110751	SCREW, mach, pnhd, 1/4–28 unf–2a x .375”	3
8	102776*	SEAL, shaft	1
9	106524*	SEAL, o–ring, Viton ®	
		6 to 11 Stage Pumps	11
		12 & 13 Stage Pumps	13
		14 & 15 Stage Pumps	15
10	110753	CAPSCREW, sch, 1/4–28 unf–3a x 1.625”	2
11	110755	WASHER, plain, .281” ID	2
12	102848*	PACKING, sq section	2
13	110752	SCREW, mach, pnhd, 1/4–28 unf–2a x .625”	3
14	103776	SCREW, hex hd, 7/16–14 x 2”	
		6 to 11 Stage Pumps	38
		12 & 13 Stage Pumps	44
		14 & 15 Stage Pumps	50
15	103777	NUT, hex, 7/16”	
		6 to 11 Stage Pumps	30
		12 & 13 Stage Pumps	36
		14 & 15 Stage Pumps	42
16	110786	PLUG, pipe, 1/4–18 npt	1
17	103780	LOCKWASHER, spring 7/16”	
		6 to 11 Stage Pumps	44
		12 & 13 Stage Pumps	50
		14 & 15 Stage Pumps	56
18	186646*	COLLET, impeller	1/Stage
19	168352*	SCREW, lock, adjusting nut	1
20	186117	GASKET, slinger	1
21	191401	COVER, slinger ring	1
22	168363	SUPPORT, bearing	1
23	186124	PLATE, instruction	1
24	168381	WASHER, .53” ID	4
25	186111	SPRING, compression	2
26	104274	LOCK, wire	1
27	171711	PLUG, special	1
28	168500*	NUT, shaft	1
29		COUPLING, motor	
	170067	fits 1.38” (35 mm) motor shaft	1
	169445	fits 1.12” (28.4 mm) motor shaft	1
30	170748*	IMPELLER, pump	1/Stage
31	186266	BASE, pump	1
32	170770*	NUT, impeller	1/Stage
33	181590	SHAFT, impeller	1
34	170772	WASHER, plain, 1/4”	3
35	207769	NUT, adjusting	1
36	218097	INTAKE BOWL ASSEMBLY	
		Includes item 36a and 36b	1
36a	179909	.HOUSING, intake bowl	1
36b	176851	.BEARING, intake bowl	1
37	218092	IMPELLER BOWL ASSEMBLY	
		Includes items 37a and 37b	
		6 to 11 Stage Pumps	10
		12 & 13 Stage Pumps	12
		14 & 15 Stage Pumps	14
37a	176851	.BEARING, impeller bowl	1/bowl
37b	179774	.HOUSING, impeller bowl	1/bowl
38	218632	TUBE, riser, 24.5” (622 mm)	
		6 to 11 Stage Pumps	2
		12 to 15 Stage Pumps	1
39	218309	BEARING, pump base	1
40	208846	RING, slinger	1
41	223605*	SHAFT SEAL ASSEMBLY	
		Includes items 41a–41e	1
41a	186215	.SUPPORT, seal	1
41b	178697	.SEAL, shaft, PTFE	1
41c	170762	.RETAINER, seal	1
41d	107246	.SCREW, pan hd mach, no. 5–40 x 5/8”	3
41e	102895*	.PACKING, o–ring, Viton®	1
46	110862	CAPSCREW, hex hd, 7/16–14 unc–2a x 1.75”	3
47	220267	PLATE, adapter	
48		KEY, parallel	1
	107055	5/16”, *use with coupling 170067*	1
	160906	1/4”, *use with coupling 169445*	1
49	178552	PLUG, 1–1/4 NF	1
50	178553	GASKET, plug, Delrin®	1
51	237534	VALVE, ball, 3/8 npt (m x f)	1
52	110754	CAPSCREW, sch, 1/4–28 unf–3a x .5”	1
53	110861	CAPSCREW, hex hd, 7/16–14 unc–2a x 1.5”	3
54	110762	PLUG, pipe, 3/8–18 npt	1
56	108027	GROMMET	1
57	186349	GUARD	1
58	223606	COUPLING ASSEMBLY	
		Includes replacement items 58a–58d	1
58a	100847	.FITTING, hydraulic, 1/4–28, 45°	1
58b	168372	.KEY, 0.187” square x 1” long	1
58c	166007*	.PLATE, retainer, shaft nut	1
58d	068069*	.WIRE, lock	1
59		SPACER	
	220008	17.75” (451 mm)	
		12 & 13 Stage Pumps	1
	220005	11” (280 mm)	
		14 Stage Pumps	1
61	107411	GREASE, Chevron SRI Grease–2 14 oz.	1
62	186248	PLUG, sealing	2
63	102982	O–RING	2
64	101748	PLUG, 3/8 npt	1

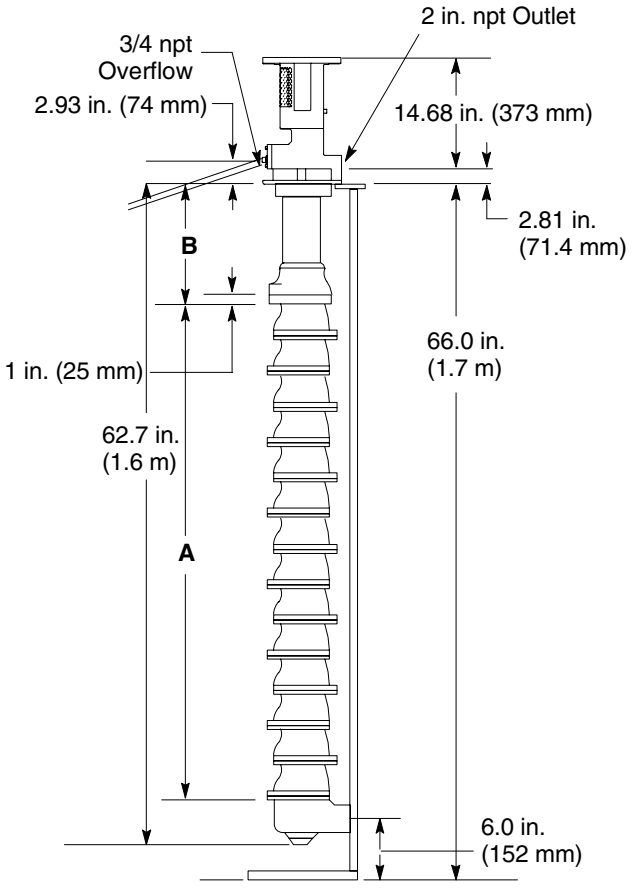
** Recommended spare parts to keep on hand.*

Dimensions

Top View of Pump Mounting Stand

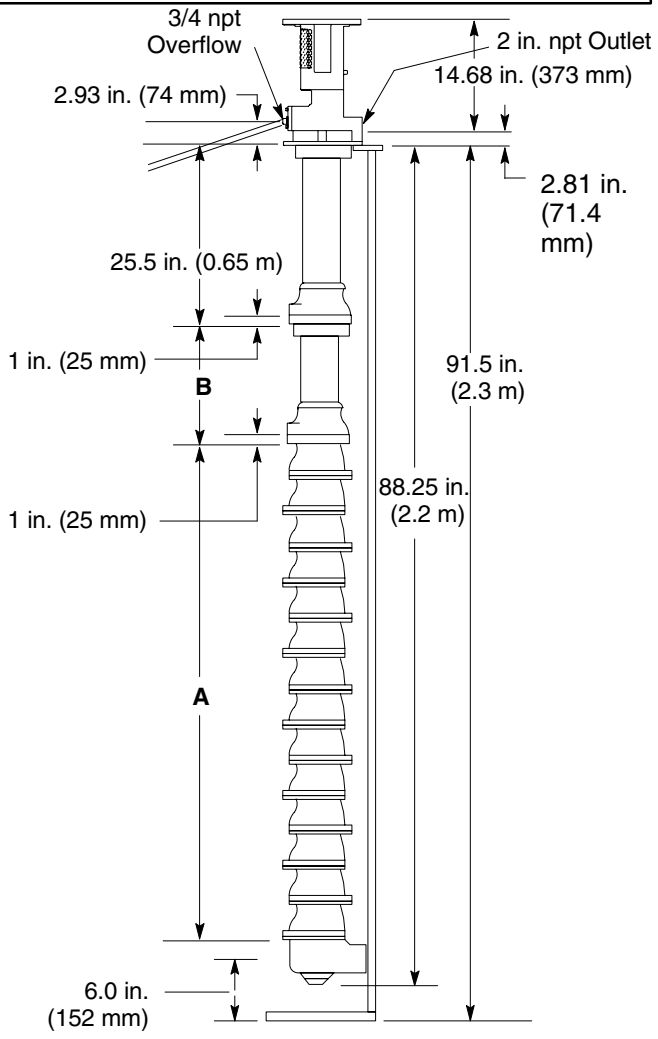


Stand Weights
220266 92 lb (41.4 kg)
218631 75 lb (33.8 kg)



(Model 223914 Shown)

Standard Size Pumps (for 60 in. High Tanks)



(Model 224014 Shown)

High Profile Size Pumps (for 85 in. High Tanks)

03138

Pump	No. of Stages	No. of Bowls	A	B	Weight lb (kg)
223906/224006/224106/224206	6	10	33.75 in. (857 mm)	24.5 in. (622 mm)	210 (95)
223907/224007/224107/224207	7	10			212 (96)
223908/224008/224108/224208	8	10			214 (96)
223909/224009/224109/224209	9	10			215 (97)
223910/224010/224110/224210	10	10			217 (98)
223911/224011/224111/224211	11	10			218 (98)
223912/224012/224112/224212	12	12	40.5 in. (1.03 m)	17.75 in. (451 mm)	220 (99)
223913/224013/224113/224213	12	12			222 (100)
223914/224014/224114/224214	14	14	47.25 in. (1.2 m)	11 in. (279 mm)	223 (100)
236615/236715	15	15			225 (102)

Notes

Accessories

Use Only Genuine Graco Parts and Accessories

⚠ WARNING

Be sure the valves, plumbing and accessories used in your system have a working pressure rating at least as high as the maximum working pressure rating of the pump.

SERVICE TOOLS

Shaft Holding Tool 207727

For High Profile Pumps.

Shaft Holding Tool 218634

For Standard Pumps.

Shaft Adjusting Tool 178779

Required for setting coupler gap.

Pressing Tool 177219

Used for pressing new bearings into bowls to maintain proper clearance of bearings.

Checking Tool 177217

Check Fixture 177218

Used with Checking Tool 177217 to check concentricity of new bearings pressed into impeller bowls.

Spanner Wrench 616637

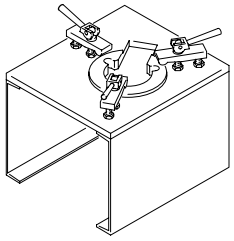
For holding impellers while torquing impeller nuts.

Chevron SRI Grease–2 107411

14 oz. Required for lubricating pump.
One tube is included with new pumps.

Assembly Stand 953912

Must be used to assemble the pump in the proper upright position, maintaining alignment.



Back Pressure Valve 208997

180 psi (1.2 MPa, 12 bar) Controlled Working Pressure

200 psi (1.4 MPa, 14 bar) Maximum Working Pressure

Stainless Steel. 0.5 in. (12.7 mm) dia. orifice.
1–1/4 in. npt inlet and outlet.
Includes 200 psi (14 bar) pressure gauge.

High Capacity Bag Filters

300 psi (2.1 MPa, 21 bar) Maximum Working Pressure

Heavy-duty, large-area perforated filter bag baskets with 1/4 in. npt blowdown port on cover. Uses optional wire mesh liner for dual-stage filtration. Ask your distributor to show you Form No. 300081 for part number and ordering information.

Fluid Pressure Gauge and Pulsation Dampeners

300 psi (2.1 MPa, 21 bar) Maximum Working Pressure

1–1/4 in. npt inlet and outlet; inline.
Flow rating: 20 gpm (75 liters/min).
Calibrated at 100 centipoise, specific gravity 0.85.

208855 For use with corrosive fluids.
1/4 npt(m) inlet. *300 psi (21 bar) Maximum Working Pressure*

206171 For use with non-corrosive fluids.
1/4 npt(m) inlet. *200 psi (14 bar) Maximum Working Pressure*

Pump Mounting Stand 218631

For Standard Pump Stand

Pump Mounting Stand 220266

For High Profile Pump Stand

Standpipe, SST 223995

Diameter: 8 in. (203 mm). Height: 61.125 in. (1.55 m)

Accessories

Use Only Genuine Graco Parts and Accessories

Adapter Kit 213049

For 10 and 15 HP Electric Motors. Includes adapter plate, coupling, coupling insert, and screws and washers.

Adapter Kit 916340

For 20 HP Electric Motors. Includes adapter plate, coupling, coupling insert, and screws and washers.

NOTE: The size of pump and motor required depends on the viscosity and specific gravity of the fluid to be pumped, and upon the flow volume and pressure required in the user's system. Users should contact a Graco branch or factory office for recommendations.

Electric U–Frame Motors

Motor	H.P.	Voltage	Rating
521470	3	230/460	Standard
521469	5	230/460	Standard
521468	7.5	230/460	Standard
521467	10	230/460	Standard
521466	15	230/460	Standard
521888	20	230/460	Standard
521455	7.5	600	Standard
51A649	3	CSA 575	Standard
51A650	5	CSA 575	Standard
51A651	7.5	CSA 575	Standard
51A652	10	CSA 575	Standard
51A653	15	CSA 575	Standard
51A654	20	CSA 575	Standard
516821	3	230/460	Premium
516732	5	230/460	Premium
516824	7.5	230/460	Premium
516825	10	230/460	Premium
516731	15	230/460	Premium
516827	20	230/460	Premium
51B297	3	CSA 575	Premium
51B298	5	CSA 575	Premium
51B299	7.5	CSA 575	Premium
51B300	10	CSA 575	Premium
51B301	15	CSA 575	Premium
51B302	20	CSA 575	Premium
114937	10	575	Inverter Duty
51B157	15	230/460	Inverter Duty
51B778	10	230/460	Inverter Duty
116228	10	380	Inverter Duty
51B673	7.5	380V/50Hz	Standard
51B674	10	380V/50Hz	Standard
51B675	15	380V/50Hz	Standard
51B676	20	380V/50Hz	Standard
51B677	7.5	380V/50Hz	Premium
51B678	10	380V/50Hz	Premium
51B679	15	380V/50Hz	Premium
51B680	20	380V/50Hz	Premium

Electric T–Frame Motors

Motor	H.P.	Voltage	Rating
521441	3	230/460	Standard
521429	5	230/460	Standard
51B296	7.5	230/460	Standard
516826	10	230/460	Standard
521456	15	230/460	Standard
521454	20	230/460	Standard
516822	3	230/460	Premium
516823	5	230/460	Premium
516774	7.5	230/460	Premium
516775	10	230/460	Premium
516776	15	230/460	Premium
516828	20	230/460	Premium
51B681	7.5	380V/50Hz	Premium
51B682	10	380V/50Hz	Premium
51B683	15	380V/50Hz	Premium
51B684	20	380V/50Hz	Premium

General Motor Specification:

Class1, Group D, Division 1 Explosion Proof, Temp. Code T2B, Class F Insulation, Vertical.

Technical Data

Power Supply required	220/575 Volt AC, 3–phase, 50/60 Hz
Flow Rate	0–50 gpm (0–189 liter/min)
Fluid Inlet and Outlet Size	2 in. npt(f)
Wetted Parts	Stainless Steel, PTFE, Viton®, Delrin®, PTFE-Coated Iron

Viton® and Delrin® are registered trademarks of the DuPont Co.

Notes

Graco Standard Warranty

Graco warrants all equipment manufactured by Graco and bearing its name to be free from defects in material and workmanship on the date of sale by an authorized Graco distributor to the original purchaser for use. With the exception of any special, extended, or limited warranty published by Graco, Graco will, for a period of twelve months from the date of sale, repair or replace any part of the equipment determined by Graco to be defective. This warranty applies only when the equipment is installed, operated and maintained in accordance with Graco's written recommendations.

This warranty does not cover, and Graco shall not be liable for general wear and tear, or any malfunction, damage or wear caused by faulty installation, misapplication, abrasion, corrosion, inadequate or improper maintenance, negligence, accident, tampering, or substitution of non–Graco component parts. Nor shall Graco be liable for malfunction, damage or wear caused by the incompatibility of Graco equipment with structures, accessories, equipment or materials not supplied by Graco, or the improper design, manufacture, installation, operation or maintenance of structures, accessories, equipment or materials not supplied by Graco.

This warranty is conditioned upon the prepaid return of the equipment claimed to be defective to an authorized Graco distributor for verification of the claimed defect. If the claimed defect is verified, Graco will repair or replace free of charge any defective parts. The equipment will be returned to the original purchaser transportation prepaid. If inspection of the equipment does not disclose any defect in material or workmanship, repairs will be made at a reasonable charge, which charges may include the costs of parts, labor, and transportation.

THIS WARRANTY IS EXCLUSIVE, AND IS IN LIEU OF ANY OTHER WARRANTIES, EXPRESS OR IMPLIED, INCLUDING BUT NOT LIMITED TO WARRANTY OF MERCHANTABILITY OR WARRANTY OF FITNESS FOR A PARTICULAR PURPOSE.

Graco's sole obligation and buyer's sole remedy for any breach of warranty shall be as set forth above. The buyer agrees that no other remedy (including, but not limited to, incidental or consequential damages for lost profits, lost sales, injury to person or property, or any other incidental or consequential loss) shall be available. Any action for breach of warranty must be brought within two (2) years of the date of sale.

Graco makes no warranty, and disclaims all implied warranties of merchantability and fitness for a particular purpose in connection with accessories, equipment, materials or components sold but not manufactured by Graco. These items sold, but not manufactured by Graco (such as electric motors, switches, hose, etc.), are subject to the warranty, if any, of their manufacturer. Graco will provide purchaser with reasonable assistance in making any claim for breach of these warranties.

In no event will Graco be liable for indirect, incidental, special or consequential damages resulting from Graco supplying equipment hereunder, or the furnishing, performance, or use of any products or other goods sold hereto, whether due to a breach of contract, breach of warranty, the negligence of Graco, or otherwise.

FOR GRACO CANADA CUSTOMERS
The parties acknowledge that they have required that the present document, as well as all documents, notices and legal proceedings entered into, given or instituted pursuant hereto or relating directly or indirectly hereto, be drawn up in English. Les parties reconnaissent avoir convenu que la rédaction du présente document sera en Anglais, ainsi que tous documents, avis et procédures judiciaires exécutés, donnés ou intentés à la suite de ou en rapport, directement ou indirectement, avec les procedures concernées.

Graco Information

TO PLACE AN ORDER, contact your Graco distributor, or call one of the following numbers to identify the distributor closest to you:

1–800–328–0211 Toll Free
612–623–6921
612–378–3505 Fax

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Sales Office: Minneapolis
International Offices: Belgium, Korea, China, Japan

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